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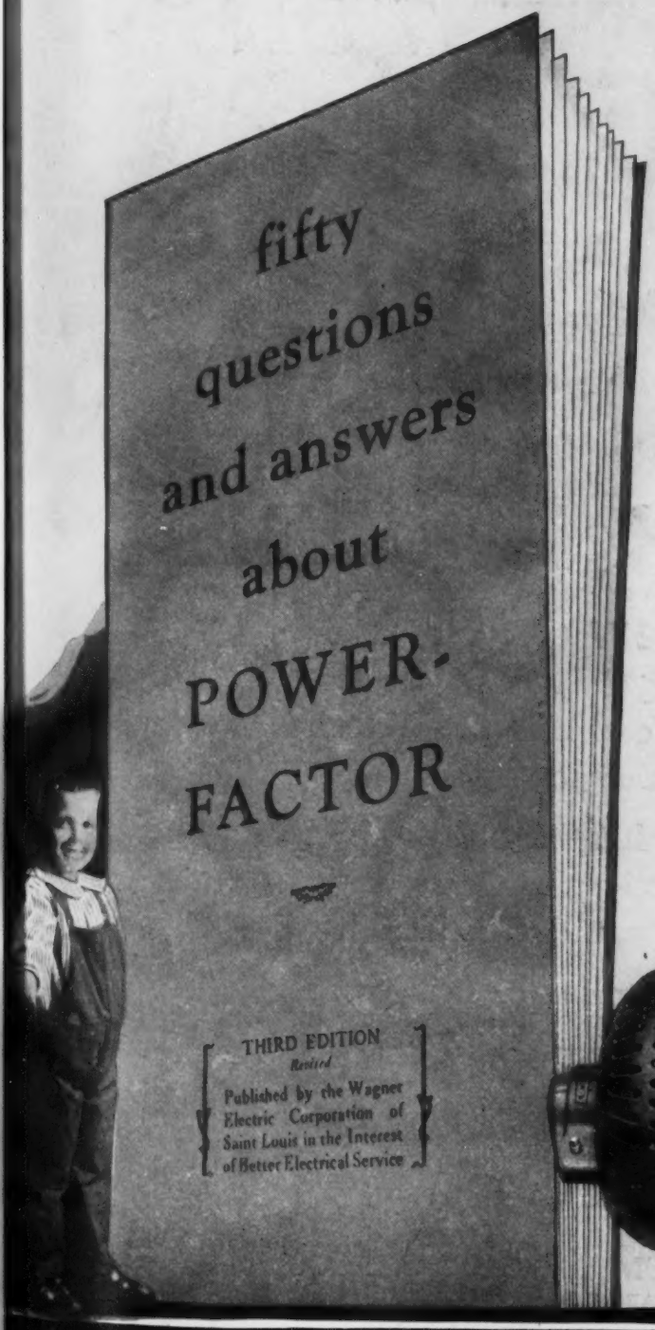

"..a little understanding of human nature"

AFTER a thorough-going study of the power-factor situation, Mr. L. W. W. Morrow, Managing Editor of Electrical World, publicly says: "Power-factor is not a technical matter today, it is a business matter * * * The bugbear of public relations has prevented many properties from embarking upon a program of power-factor correction. This objection is mostly imaginary if correction is instituted with intelligence and a little understanding of human nature. In no case has any noticeable effect been had on public relations and in several instances the intimate contacts brought about through the institution of correction have really improved relations."

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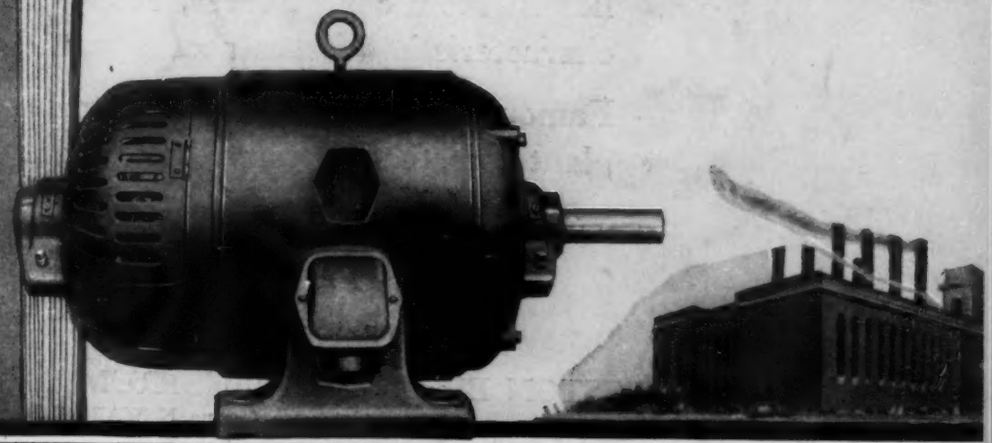

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Electrical World

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W. H. ONKEN, JR.
Editor

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Major Activities Are Well Defined

A SURVEY of conditions in the electrical industry shows that every one is busy and prosperous. Each functional group has accomplished a great deal and has defined the tasks that remain to be done.

Utility executives are busied in perfecting and consolidating their properties. Major considerations in their minds are finance, public relations and economical and good service. They have found that the best approach to improve their business is through rendering good service at a fair price and are busy planning to continue and extend electric service to their customers.

The engineers are striving to keep pace with the extensions of properties and the increased demands for reliable service. They plan system development schemes that will be capable of indefinite expansion and try to adapt existing installations to fit in with the plans.

The commercial staffs are very busy. They realize their great opportunities for increasing the sale of electric service and appliances. They strive to attract executive support for their programs to light homes, operate all factories and make this a truly electrified country. They struggle with the eternal rate questions and try to form a co-operative team with dealers and contractors in order to bring about harmonious and rapid business developments.

The electrical manufacturers are trying hard to attain a degree of co-operation and organization which will help them do business more easily and more profitably. The question of industry statistics is to the front and must be answered. Then again there are problems connected with the reorganization of their associations and the establishment of standards—problems which are difficult of solution but whose solution will bring large possibilities for improvement. Above all, they are seeking to develop the equipment needed by their customers.

In all phases of electrical activity important problems are encountered, and it is encouraging to find an ardent and active group of workers seeking their solution. The past history of electrical progress shows that once a problem is defined and attacked intelligently a solution follows.

Shading Light Is Profitable

PREACHING the gospel of shaded light should be inspired by a desire to protect people from their own carelessless, indifference or even ignorance. Habits formed in the years when light sources were not what they should be are not easily broken. Furthermore, the harmful effects of improper and inadequate lighting are subtle and indirect. Nearsightedness, nervousness, accidents and many indirect effects of careless lighting seem to be so unassociated with their direct cause that it is not readily apparent. Naturally a question arises as to the effect of the humanitarian movement for shaded light upon central-station revenue.

It is true that improper lighting is often wasteful because light in large quantities is emitted in directions where it is not wanted. If this light is diffused without altering the general distribution of light, some light is lost without increasing the intensity of illumination where it is desired. If the light source is shaded, more light may be directed where it is desired, but the illuminated area is restricted. This is done in the living room by means of a portable lamp. With this restricted area another portable lamp is needed for another portion of the room. The consequence is that in place of one unshaded fixture two or three or even more "portables" are needed. This is what the householder pays for comfortable shaded light. Shades waste light in diffusing and tinting what light is left and thereby make the remaining light more valuable.

An interior in which light sources are unshaded seems overlighted. When shades are used the restful, comfortable lighting does not seem to be overdone. In fact, persons will choose much greater intensities of illumination from shaded lamps than from unshaded ones. Finally, the desire for lighting will increase in ratio with the comfort that it affords. The net result of the gospel of shaded light will be more energy consumption and pleased and protected customers.

The Drought in the Southeast

THE Southeastern States suffered an unprecedented water shortage last year. It was greater than could have been anticipated from a study of rainfall records covering many years. Under these conditions the light and power companies gave almost normal service to their customers and weathered the shortage successfully, thus proving that their managers had built well and soundly.

Valuable lessons may be learned from experiences of this character. Real tests are offered of the quality of public relations, of management and of organization spirit. In addition, valuable data are available to determine how interconnections should be utilized, how systems should be built and how intercompany relationships should be established. A study of the article on this subject in last week's issue of the ELECTRICAL WORLD and of the one in this week's issue shows that the drought proved that each utility had good relations with its customers on which co-operative efforts could be founded. It shows that interconnections can be used to relieve any property in a group from the necessity of curtailing service to customers. It shows that the full value of interconnection is obtained if the largest possible number of utilities are linked together so as to give a maximum possible system reserve and diversity of climatic, generating and operating conditions.

The complete analysis of the effect of the drought should show the amount of steam reserve the customers on each property should support in order that any property in the interconnected group may be guaranteed against disaster when—perhaps only once a century—

so severe a drought or some other grave interference through an act of nature occurs. A necessary development is a close co-operation among executives of the different companies, as well as among operators, so that building and extension plans can be carried out at the time and the place which coincide with the best interests of the interconnected group as well as those of an individual property.

The light and power companies in the Southeast are all young and had not completed their full development program when the drought occurred. It is remarkable that under these conditions they encountered a severe trial so successfully. They are to be congratulated on the excellence of their leadership and on their skillful operators. Experiences of this character, while unfortunate, go far to show the sound structure private enterprise has built for giving electric service.

Voltage for Home Use

IT IS apparent that domestic loads have grown so large that serious attention must be given both to voltage regulation in the homes and to wiring in the homes. The houses are becoming miniature machine shops with a variety of motors and heating devices which are bound to cause voltage fluctuations if the wiring does no more than comply with the formal Underwriters' regulations. Some of the appliances, such as the electric refrigerators, automatic pumps, ventilating motors and oil-burner motors, have no respect for time or load and may start up at the peak period or at night when all lights are burning. These voltage fluctuations are annoying because of their effect on the lights, and they may become more so as relays and controls are developed and used for household applications.

The utility may enlarge transformers and secondary distribution copper and yet not improve the situation materially. The answer to the problem lies in the wiring of each home, the motors used on devices and the development of some kind of house voltage regulator. All electrical men who study this situation will admit its serious character, for even now it is affecting the development of domestic load.

Making Control More Adaptable to Automatic Operation

ATTENTION has been called to the necessity of manufacturers supplying relay and control apparatus which is adapted to automatic substation operation instead of always trying to apply standard apparatus which has been used for similar purposes. Although standard equipment can be used with complete success for various applications in automatic substations, it is none the less true that some standard apparatus which is perfectly suitable for a similar but not the same purpose is inadequate for automatic substations and sometimes almost useless. For such purposes the standard equipment must be modified or new equipment designed with the particular requirements in view.

Sufficient ruggedness and accuracy are two properties declared to be lacking in many relays and pieces of control equipment. More accurate time, voltage and current settings are required in automatic stations than for other applications. Voltage regulators, one company points out, are not sufficiently sensitive for dense direct-current networks. Trouble has also been experienced in one installation with the combinations of the reverse relays on rotaries with tap-changing control for restarting. If the relay trips, the tap changer takes 50 seconds to re-establish operation.

Sometimes operators are too insistent on having equipment specially designed for every purpose, allowing their personal hobbies to play havoc with economy. Wherever adaptable, standard equipment should be used because development of special equipment is a great financial burden on manufacturers which they in turn must shift to the user. The question arises, however, whether all manufacturers are consistently and conscientiously apprising themselves of the performance records of their equipment in various applications so that recurrent troubles will be avoided.

Operators can establish a guide to systematic inspection and maintenance and also help manufacturers in their development work by assembling in readily digestible form facts regarding the performance of specific pieces of apparatus so as to show recurrent troubles. This information coupled with specific requirements of the service should indicate how equipment may be modified or developed to give complete satisfaction.

In making these improvements, in modifying standard apparatus and in developing new which will benefit various users and possibly lead to a greater market, a wide commercial policy is followed by manufacturers who arrange to distribute the development expense over a period of time so that the pioneers or users who co-operate the most in development will not have to share such a large part of the burden.

More Highly Penetrating Rays

IT HAS long been known that sensitive gold-leaf electroscopes lose their charge more rapidly than can be accounted for by leakage over their insulation. This fact was noticed shortly after the discovery of radioactive substances, and it was at first supposed that the slow leak was due to the influence of emanations from radioactive substances within the body of the earth. It was later found, however, by experiments taken over the surface of the ocean that this explanation was not sufficient. Ocean water is highly absorbent of radioactive influence or rays, and the leak of the electroscope was also observed over the ocean. This forced a consideration of some type of ionizing influence arising outside the earth, and physicists have been speculating and experimenting for some time on this hypothesis.

The recent announcement by Prof. R. A. Millikan of a new type of high-frequency rays of cosmic origin is a result of extensive experiments directed toward a test of the question of an ionizing influence external to the surface of the earth. It is known that both the atmosphere and masses of water absorb the radiation which causes ionization and leakage of the type mentioned. Millikan's experiments, therefore, were conducted by means of balloons carrying his instruments to exceptionally great heights, and also by observations taken on electroscopes lowered into very deep lakes, themselves situated on high mountains. The latter experiments eliminated the absorbing influence of the lower layers of the atmosphere and provided opportunity for studying the absorptive effect of water. The experiments in the lakes showed a continually decreasing rate of leak of Professor Millikan's electroscopes down to a

depth of 45 ft. of the mountain lake. Computations indicate that this, together with the atmosphere above, represents an equivalent of six feet of lead before the rays are completely absorbed. This represents rays much harder—that is, more penetrating—than any which have before even been imagined. The most penetrating X-rays which have ever been produced cannot go through an inch of lead, and here is evidence of rays originating somewhere out in space at least a hundred times more penetrating than X-rays. Millikan's further computations indicate that these rays are spread out over a definite range of frequencies, probably on the average one thousand times the mean frequencies of X-rays, and that the shortest waves observed are in frequency only about one-fiftieth of the hardest radioactive ray heretofore known; that is, about one ten-millionth of the wave length of ordinary light. It is suggested by the experiments that the rays come from all directions in space, and that possibly they may be due to nuclear transformations enormously more energetic than any which take place in known radioactive changes. The suggestions made are that these transformations may be due to the formation of helium out of hydrogen or to the capture of an electron by a positive nucleus. Whatever be the explanation, it seems certain that the experiments indicate an activity outside the earth's envelope which may arise in the outmost limits of known space and which is indicated on the earth through oscillations far more rapid than anything of which we have dreamed.

Care Needed in Selection of Penstock Valves

AN ANALYSIS of causes of penstock failures, which have been too frequent in recent years, particularly on the Pacific Coast, shows that valves of one form or another have usually been the direct or indirect cause of the break. Unquestionably the penstock valve is one of the weakest points in the modern hydro-electric development. The main difficulty with such valves is their tendency to close or to open too rapidly, thereby setting up pressure variations which may prove destructive to the penstock.

All well-known types of valves have been applied to hydro-electric practice, but each may develop some weakness or fault under certain operating conditions. Some types of valves were not designed or intended to be operated with full velocity in the penstock. Perhaps there are cases where the cost of a valve which will operate satisfactorily and safely under full flow is not justified, but to provide no penstock valve that could be so operated would be to deprive the plant of one of its most important safeguards, i.e., that of protecting the power house and equipment under emergency conditions when the flow of water under full discharge velocity must be stopped.

A valve at the power-house end of a penstock in order to perform its full function must be a device which can be moved accurately, positively and safely under all conditions. To meet these requirements present-day thought in valve design is tending toward a type in which the movement of the valve is parallel to the flow of water.

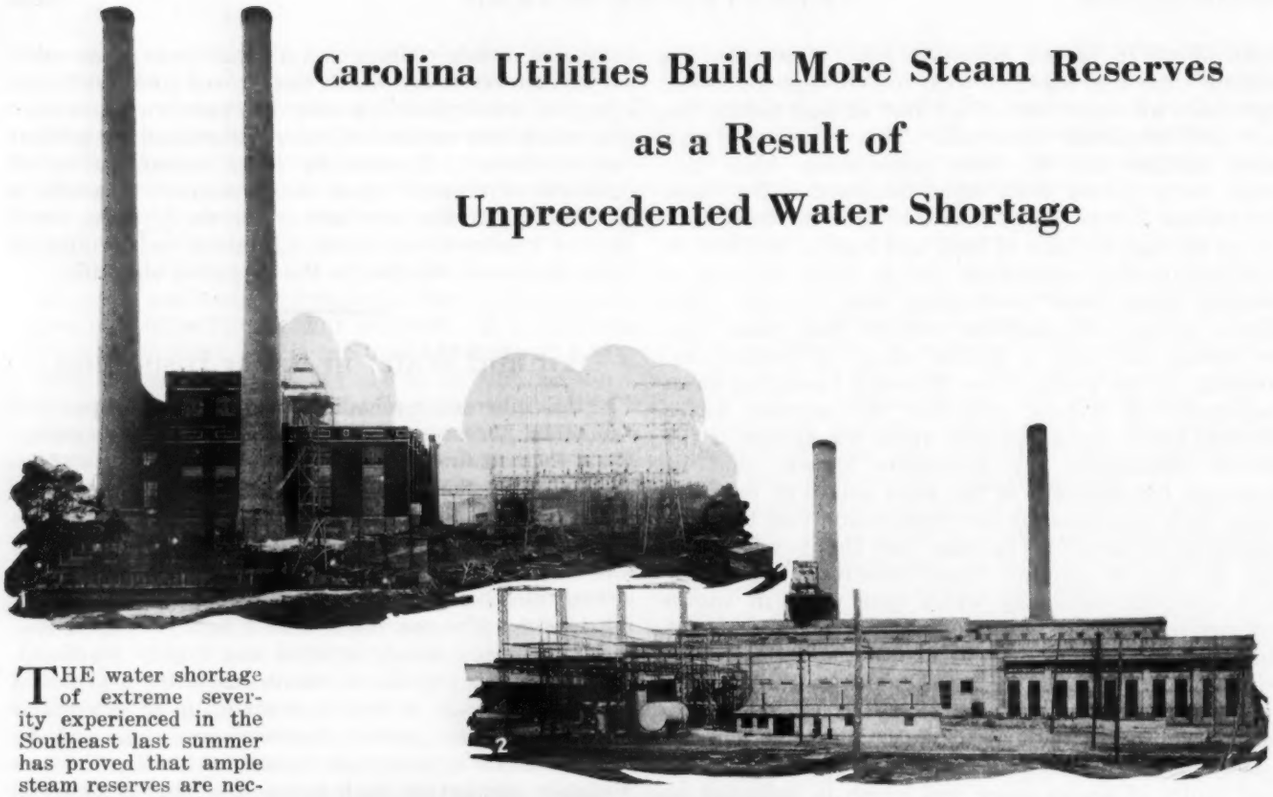
Although valve design for hydro-electric practice has received the attention of some of the ablest hydraulic engineers in this country and abroad, there is no valve on the market today which has proved universally adequate to the services imposed. The past few years have seen much improvement in valve design, and the present concentration of thought by large manufacturers of hydraulic equipment upon the problems it entails is encouraging to the user and is certain to bring about further improvements which will make such equipment safer and more reliable for the operating company.

Air and Water in Paper Insulation

THE inherent mechanical properties of paper and other fibrous materials are not such as to recommend them at first sight for use as electrical insulators. Nevertheless, they lend themselves so conveniently for application to the usual type of conductor, with its often irregular cross-section and short radius bends, that they are used very widely. This usage requires as a companion material some form of liquid or impregnating binder. The combination as a final insulating material has been widely studied and highly developed. Nowadays it is possible to obtain insulation a principal part of the body of which is made up of perishable fibrous materials, which, however, are preserved by immersion in a insulating liquid or binder, the two mutually supporting each other, the fibrous material giving mechanical rigidity to the dielectric and the latter in turn supporting the fibrous material electrically and chemically.

Continued study of impregnated insulation has brought out clearly the importance of the elimination of water. The influence of entrained air is not so well understood, although it is suspected that thin layers of air break down under electric gradient and cause slow deterioration. The ordinary processes of manufacture are favorable to the inclusion of both water and air, nothwithstanding great care in the effort to eliminate them. A recent number of the *General Electric Review* presents the results of some experiments by Messrs. Davey and Wilson on the influence of both air and moisture on the conductivity of insulation consisting of paper and linseed oil. They show the enormous importance of the amount of water content and also present figures showing the relative influence of air and water. Removal of entrained air and water together at ordinary temperatures may increase the effect of resistance 12,000 times, while the removal of air alone may increase it 140 times. These effects are not so pronounced at higher temperatures. An interesting result is that the amount of entrained air depends considerably on the method in which the impregnated material is admitted to the paper. The experiments are being carried on an elaborate scale, and they indicate how powerful an agency a large manufacturing company can be in the field of research and advance of applied knowledge. Further results on the subject of impregnated material are promised, and it is hoped that these studies will extend to the field of dielectric absorption. It is a simple matter to increase the resistivity of such materials to a point which represents negligible loss and therefore low rate of deterioration, provided also that the dielectric absorption is low. Reliable data on the relation between resistivity and absorption and methods for controlling this relationship are badly needed.

Carolina Utilities Build More Steam Reserves as a Result of Unprecedented Water Shortage



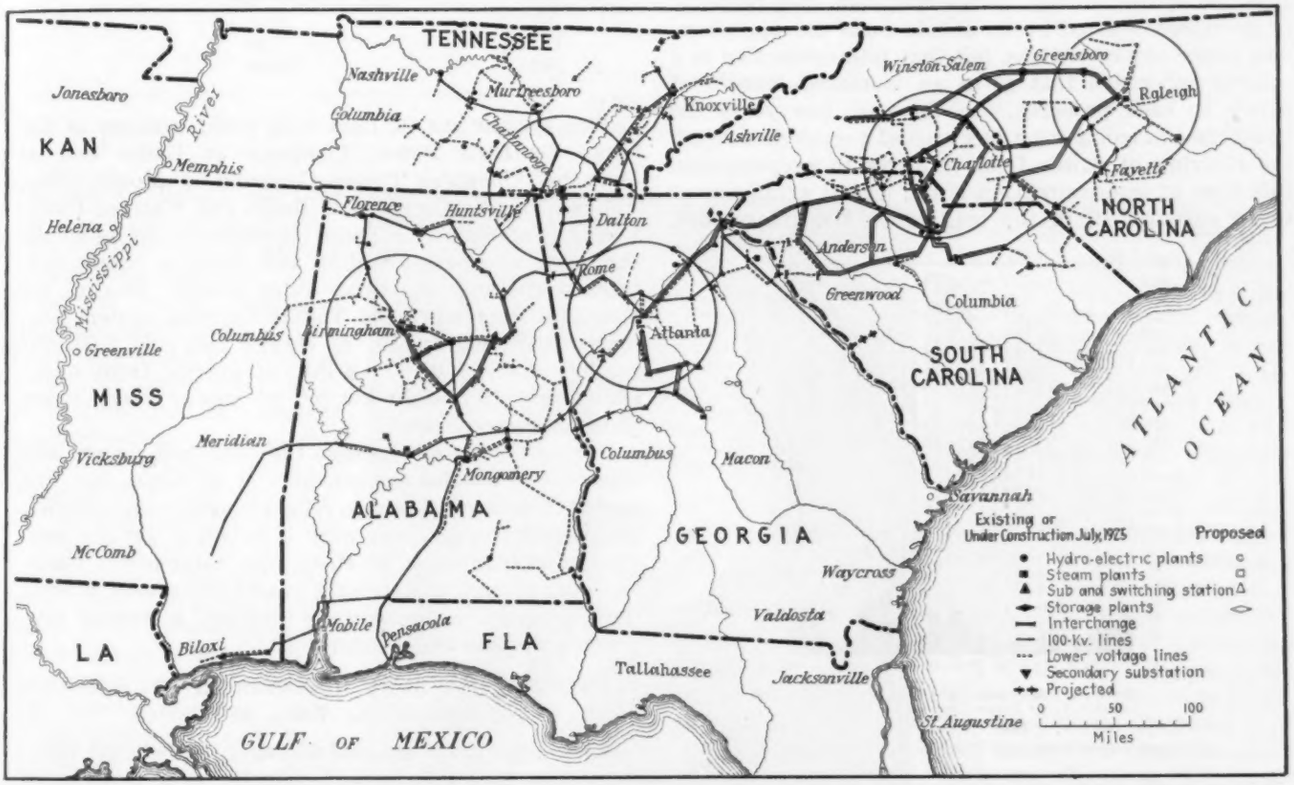
THE water shortage of extreme severity experienced in the Southeast last summer has proved that ample steam reserves are necessary for continuous service. Most of the properties had built reserves which were able to carry service even under the unprecedented conditions experienced.

Typical Stations of the Southern Power Company

No. 1.	Duncan,	30,000 kw.
No. 2.	Mount Holly,	37,500 kw.
No. 3.	University,	27,500 kw.
No. 4.	Rhodhiss,	31,975 kw.

Water Shortage in the Carolinas

Utilities Placed on Own Resources Largely, Although Interconnection Aided Service—Unprecedented Conditions Were Encountered, Yet Service Was Almost Normal



THE SOUTHERN INTERCONNECTED SYSTEMS WHICH EXPERIENCED THE WATER SHORTAGE

DURING last year the utilities in the Carolinas operated more or less as an independent interconnected unit in the great interconnected system of the South. Adjacent utilities, as outlined in last week's issue of the ELECTRICAL WORLD, had no power available to help the Carolina groups, and even in this region the different utilities operated very largely as independent units.

EXPERIENCES OF THE SOUTHERN POWER COMPANY

The Southern Power Company operates a large hydro and steam system. The hydro development program is not yet complete and at the beginning of the shortage consisted of a large number of plants located at the head of the streams and some weekly, monthly and yearly storage pools. The development of the system has been based on building hydro and steam plants that will make the system self-supporting.

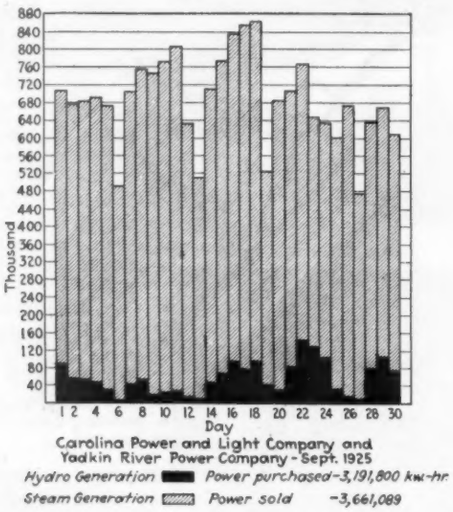
The management of the utility has long recognized the necessity for steam plants and storage pools and had built the system on the basis of reserve 50 per cent greater than any minimum water period known. During last year there was an unprecedented water shortage and the river flow was materially less than 50 per cent of the lowest volume on record. As a result there was a power shortage and a changed program of development that will be based on a 50 per cent reserve with the present unprecedented minimum flow as the basis of computation.

No appreciable rain has occurred in the territory since Feb. 1 and the total steam reserve of the system has been operated since that date. The normal rainfall is about 47 in. and the year 1925 had only about 22 in., yet the management operated the system so skillfully that no real curtailment was necessary until the middle of August. A storage of 20,000,000 kw.-hr. in excess of schedule was made in January and the schedule of storage was maintained until July 1 by promptly operating all steam plants on Feb. 1. Stream flow and storage was then utilized from about July 15 to Aug. 15 in conjunction with the steam plants and energy that could be purchased from other utilities and from customers. But in the middle of August the stream flow practically stopped in a period of about ten days and it was necessary to draw down on all storage and to begin to curtail power. Power customers were requested to change their hours of operation and to adjust their operations to fit a curtailment program that gave the best possible load factor on the system.

Interconnection played some part in the situation early in the shortage, but during August and September the neighboring properties could aid very little, as they were facing an equally critical situation.

According to C. I. Burkholder, the Southern Power

Company is now rapidly completing developments that will give the system about three times the present large water storage facilities and in addition is building a 70,000-kw. steam station to add to the existing steam capacity of 106,000 kw. and hydro capacity of about 469,925 kva. No change has been made in the major plans of development of the utility except to increase magnitude of the reserve in steam and water storage in the light of the new minimum conditions encountered. It is the opinion of Mr. Burkholder that each property in an interconnected group should build to supply service under any conditions, but that interconnection is a reserve safeguard that gives an increased margin of safety to each property. In the past few years the Southern interconnection has worked very well through the relaying of power from property to property and this type of interconnection is the logical arrangement to be encouraged, in the opinion of Mr. Burkholder.



ENERGY GENERATION AND SALE OF THE CAROLINA POWER & LIGHT COMPANY AND THE YADKIN RIVER POWER COMPANY DURING SEPTEMBER

The emergency during the past year even with the large steam reserve on the system and contracts with adjacent utilities proved that each utility must care for its own customers in the final outcome, but conditions of like severity have occurred only once in 60 years and other experiences in the past have brought out very decided advantages to service through the operation of relay interconnections.

CAROLINA USES STEAM

Water shortages have been experienced during the past two years in North Carolina and the utilities had largely anticipated the present shortage by installing steam-generating stations. Most of the water-power developments in North Carolina have been stream flow, although some storage is available on some utilities. Very largely, however, the rivers are small and short and have wide fluctuations in stream flow.

The combined Carolina Power & Light Company and Yadkin River Power Company system is the largest utility in North Carolina operating in the southeastern interconnected group. This system has a total owned and leased hydro capacity of 65,455 kw., of which 14,000 kw. is purchased under contract from the Wateree Power Company and 20,000 kw. from the Tallassee Power Company. The total owned and leased steam capacity is 38,510 kw. and it will be noted that these utilities own more steam than hydro generating capacity.

Operating conditions and the changes brought about by the unprecedented water shortage of last year may be noted by a study of the following data for the month of September:

Year	Ratio of Steam to Hydro Generation, Per Cent
1923	6.42
1924	1.42
1925	18.00

This system has tie lines with other systems as follows: Southern Power Company at Badin and at Durham, Tidewater Power Company at Mount Olive, Tallassee Power Company at Badin and Wateree Power Company at Wateree. These interconnections lie within the State of North Carolina and serve to handle contract power and emergency relay power. During the month of September the Yadkin-Carolina system purchased 3,191,800 kw.-hr. of energy and sold 3,661,089 kw.-hr., and 1,750,500 kw.-hr. of energy from hydro plants and 18,738,820 kw.-hr. of energy from steam plants were produced.

During the water shortage the combined system was able to give service to customers at all times, but was unable to do a great deal to relieve neighboring utilities. Great initiative and care were exercised to get the most efficient utilization of all steam and water-power plants and even though the streams practically ceased flowing the Carolina-Yadkin company pursued a normal program of service and development.

INTERCONNECTION MUST BE CONSIDERED IN RELATION TO ECONOMY AS WELL AS SERVICE

P. A. Tillery, the general manager, stated that interconnection had proved very valuable over a series of years. It enabled utilities to pool resources and to take advantage of diversity in different sections. In emergencies, also, neighboring systems could aid greatly the property experiencing difficulty.

Discussing the shortage, Mr. Tillery said utility managements must consider it on an economic as well as a service basis. If reserves are installed in large volume, their cost must be borne by customers, and if they are used only once a century, it is questionable if this large financial burden is warranted. In addition, he pointed out, the growth of network interconnections made it possible for any utility to rely upon its neighbors with a greater degree of safety as the years elapsed. In a few years a local emergency should be cared for with very little trouble by the interconnected system as a whole.

INTERCHANGE OF ENERGY ACROSS STATE BOUNDARIES IN THE SOUTHEASTERN INTERCONNECTED SYSTEM

(Comprising North and South Carolina, Georgia, Tennessee and Alabama)

	Total Supply, Kw.-Hr.	Total Delivered to Other Companies Crossing State Line, Kw.-Hr.	Total Interstate Consumption, Kw.-Hr.	Per Cent Delivered Beyond State
1921.....	1,353,513,866	40,336,272	1,313,177,594	3.0
1922.....	1,627,524,031	74,188,544	1,553,335,487	4.6
1923.....	2,043,579,403	92,752,490	1,950,826,913	4.5
1924.....	2,179,782,457	60,434,447	2,119,348,010	2.8
1925*.....	1,667,211,453	104,953,296	1,562,258,157	6.3
	8,871,611,210	372,665,049	8,498,946,161	4.2

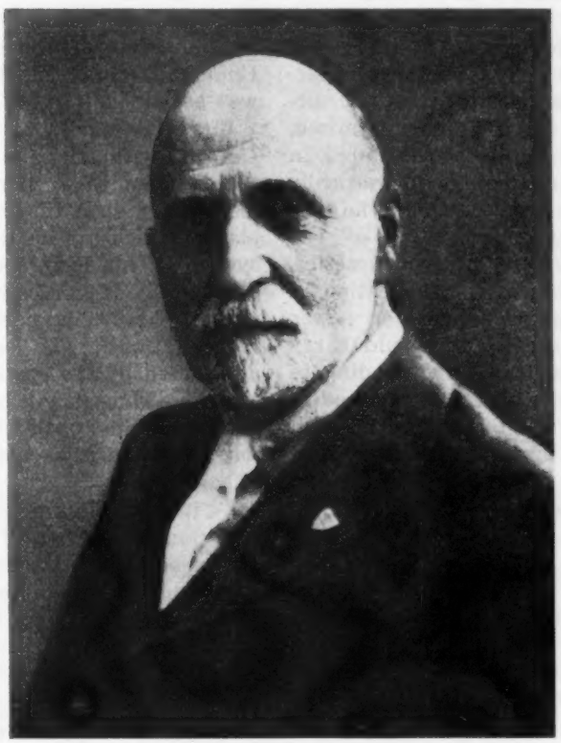
*These amounts represent the period from Jan. 1 to July 31, 1925.

Loose-Linking of Large Power Sources

One Method That Has Been Successfully Applied by the Detroit Edison Company to Minimize System Disturbances and Reduce Duty on Oil Switches Without Sacrificing Flexibility and Economy of Operation

An Interview with
ALEX DOW
President Detroit Edison Company

"LIKE a radio vacuum tube on the verge of oscillation—highly efficient but damnably unstable," is an expression which electrical men have heard applied facetiously but which nevertheless has a sober application to solid interconnections of concentrated power sources. The solution of the problem has been discussed by many persons, but it is still bothering a number of companies and will confront others as they increase their interconnected capacity in contrated areas or even over extensive areas if heavy trunk lines are used to tie solidly large sources of power. Different companies and individuals have their pet ideas on how the problem can be solved. Time will show the efficacy of these methods.



ALEX DOW

For one example of what has actually been accomplished, Alex Dow, president of the Detroit Edison Company, was interviewed recently by a representative of ELECTRICAL WORLD regarding what he calls the "loose-linking" of his system. This system has been evolved and gradually perfected since 1920. Generating capacity of more than 500,000 kw. and a mass of 24,000-volt cables are involved.

"What is the distinctive feature of this system?" Mr. Dow was asked.

"Our system is not a closely connected unity served by several power houses," he replied. "Instead, I like to think of it," he continued, "as several contiguous areas having their own sufficient power houses interlinked primarily for mutual assistance and secondarily for attainment of maximum economy. The 'loose-linking' is not new or untried. Continually increasing demands and generating capacity, together with the close knitting of the transmission system, forced us into it back in 1920. Oil circuit breakers and consequently the service were becoming jeopardized by the large amount of generating capacity back of them. The whole connected capacity was ever ready to spill an immense amount of energy into a fault whenever one developed. We can't, and no company can, afford to allow conditions to continue that are favorable to system-wide disturbances."

Questioned as to the fundamental factors that influence the development of the system, Mr. Dow said: "Loose-linking throughout the entire Detroit Edison system is an ideal toward which we have been striving for five years, but which we have not entirely attained yet, although we are very close to it. Economy is subordinate to the first purpose of interlinking—namely, mutual assistance. Therefore the manner and extent of interlinking should be such as will permit the transfer of energy between contiguous areas when needed and to the amount required by any controllable operating disturbance affecting the area which needs assistance. Interlinking should not be so tight that disturbances of the service that are temporarily uncontrollable will extend from the area in which they originate into contiguous areas. In other words, all of the ordinary chances of trouble, such as disablement of a turbo-generator set or the loss of an important line, should automatically bring sufficient assistance into the disturbed area from other areas. But an uncontrolled disturbance—which in practice means some vicious short circuit causing generators and synchronous machinery to break out of step—should not be complicated nor aggravated by having the energy of more than one area dumped into it. Nor should such a disturbance be permitted to extend into other areas than that in which it originates. The foregoing requirements can be met by limiting the number of points at which energy may pass from one area to another and by providing adequate automatic switchgear at each of these points."

"Are the boundaries of areas to be served from your Marysville, Connors Creek, Delray and Trenton Channel steam plants and the Huron River water powers rigid in this scheme of operation?" Mr. Dow was asked.

"Emphatically no," he replied. "The areas must be proportional to the amount of power available at the moment from each of the power houses, and that amount varies from time to time. The system operator, in consultation with the production department, assigns to each power house the amount of load it is to carry

from hour to hour. Each large change of this assigned duty will necessitate relimitation of the areas of supply."

"How is this periodic expansion and contraction of service areas practically effected?"

"There must be a multiplicity of possible interlinking points," Mr. Dow pointed out. "The number and locality of interlinkages in use at any time must be varied in consonance with the duty assigned for the time to each power plant. The system operator must not only prescribe the points of interlinking and the normal carrying capacity of each interlinkage, but must in the final refinement prescribe the overload at which the interlinkage will automatically disconnect.

"When these conditions are met, a disturbance originating in any power area, if successfully controlled, will cause a minimum of trouble, because its effect will be relatively small compared with the total power capacity available to maintain the service. If it is not successfully controlled, its effect will still be minimized, because the disturbance will be limited to the area in which it originated, by that area being automatically disconnected from the other areas to which the disturbances might otherwise spread.

"While not yet fully met in our present practice, one important requirement of successful application of this method is that when a power house (or power area) breaks loose from the others, it should carry with it a proportion of the total load corresponding to that proportion of the total load which was assigned to it for the time being. If it carries too much load with it, then a needlessly large amount of service will be affected by the disturbance. If it carries too little load with it, the other power houses will be temporarily overloaded.

Limitation of Interlinkage Connections

"Another requirement is less evident," added Mr. Dow, "but is desirable—namely, that the interlinking of any power area should not be effected with more than two other areas. That is to say, it is not desirable that each area should be interlinked directly with every one of the others, but with only one or two."

"Has this loose-linking idea been applied clear through the system—for example, between the generators in the power plants?" Mr. Dow was questioned.

"It has been applied to one power station and will be carried further," declared Mr. Dow. "At the Connors Creek plant the ring bus is split into two main sections, with generators and lines on each section, resulting in two separate buses and two separate transmission line groups. When these lines were tied together only at the substations, the maximum short-circuit current at Connors Creek plant was cut down considerably, but the current values in the substations were not cut down appreciably beyond those previously obtained, because lines emanating from both buses were joined in the substations. However, lines to the nearest substations are being cut over at the power source, so that all lines to the same substation will be on the same main bus but on different bus sections. This method of operating has been found satisfactory and will be continued with perhaps some modification according to new load requirements and principles of economy. Separation of station buses may eventually be followed by a separation or loose-linking of the steam system for similar reasons of reliability.

"While it is not the case now," pointed out Mr. Dow, "we are avoiding the installation of switches within large power houses to prevent switch wrecks putting the power stations out of service. Interlinkage switching stations should also be separated from distributing substations and should be located and built in due sequence in advance of necessity."

Pointing to a map in his office, Mr. Dow indicated that all substations serving important areas are gradually being adapted to service from 24,000-volt loops fed over separate conduits or pole lines from two directions and two separate sources of power. "The switchgear should have large excess capacity, or at least provision should be made to substitute quickly a switch or switches of larger capacity when conditions change," he declared.

"How does the 120,000-volt double-circuit loop around the outskirts of Detroit from Marysville to Trenton Channel fit into this loose-linking scheme?" Mr. Dow was asked.

"It is primarily to enable feeding the outskirts of Detroit without running high-voltage large-capacity cables from the generating plants themselves, but it also serves as a tie between our two most economical plants, which are on the extreme opposite sides of our system. This loop, consisting of two parallel circuits each nearly 120 miles long, can be divided into approximately three equal parts by means of the two sectionalizing stations. The loop is also tied at certain points, designated by the system operator, with the city cable system. Thus it will be seen that the loop is provided with loose-linkages and the same opportunity for flexible operation as is obtained with the city cable interlinkages."

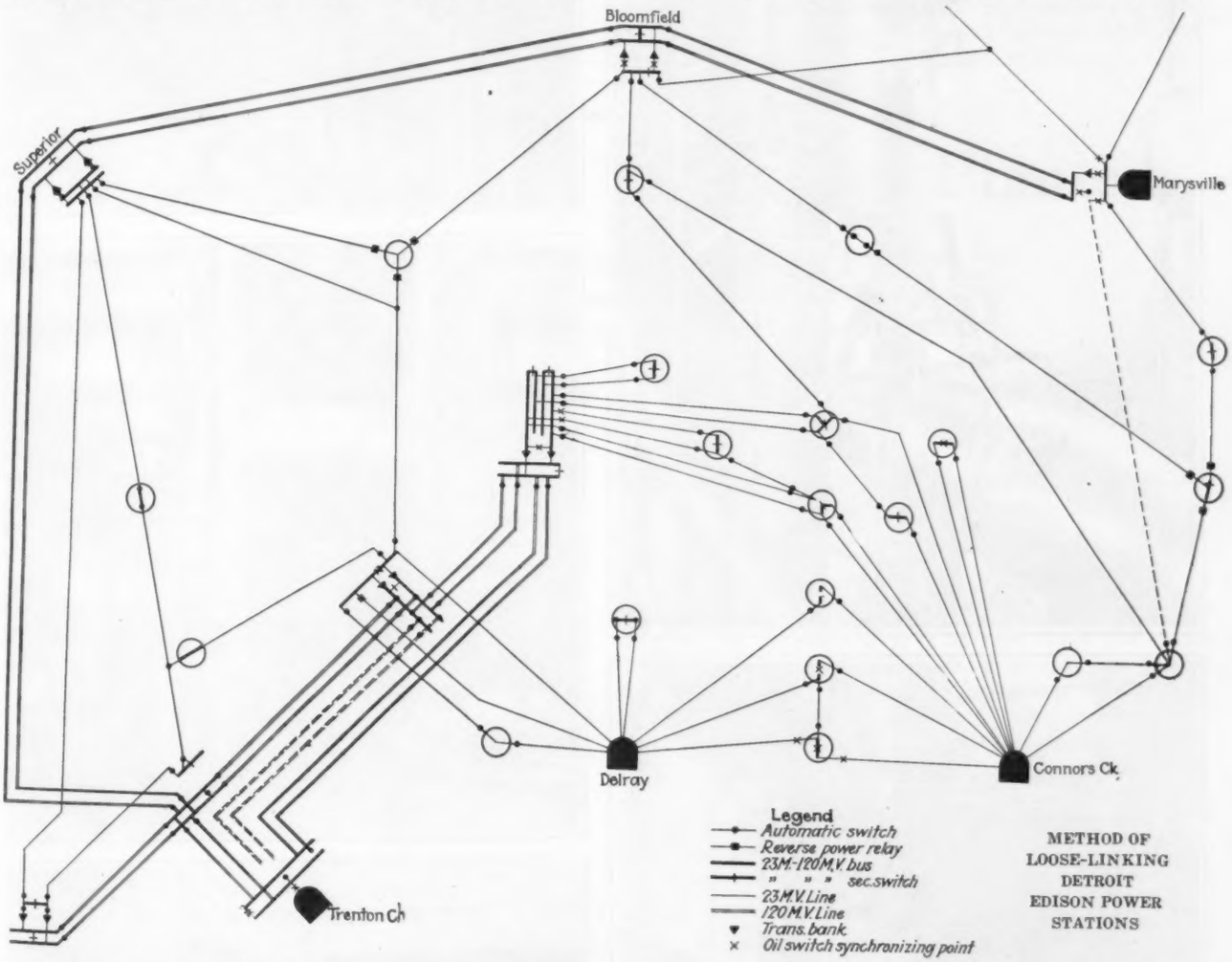
"With loose-linking, as understood by most persons, it is considered that all generating stations in a system cannot be held in synchronism and that the load cannot be divided for the greatest economy," it was explained to Mr. Dow, to which he retorted: "It should be distinctly understood that this arrangement represents only a partial separation of the system and that all generators continue to operate in parallel on the main system and carry the allotments of load as determined by their best efficiency. As explained before, partial separation is accomplished merely by minimizing the number of main interlinkings in the transmission system and providing the option to close as many smaller loop tie lines as the exigencies of the occasion demand. For example, the demand in adjacent districts for power to be supplied from the corresponding power station may require the closing of only one tie consisting of one pair of No. 2/0 cables at one substation or another. Between Connors Creek and Delray this tie would hold the two generating plants in synchronism without any difficulty, so that, if necessary at any time, the two systems can be tied together quickly at any other substation or interlinkage point, temporarily perhaps, until other switching or manipulation of load has been made according to the conditions arising. Although it is true that any instantaneous exchange of power between two adjacent plants is normally limited to the one tie, it must not be overlooked that considerably more load can be transferred between adjacent areas by different switching combinations at the various interlinkage stations. It has been possible to maintain the system economy as high as with the customary solid interconnection between stations, but without the possibility of serious derangement of the whole system which is thereby permitted."

"How about the utilization of your investment in equipment; isn't more reserve capacity required and aren't expensive tie lines installed which are in service only a part of the time?" Mr. Dow was asked.

"It seems to me," replied Mr. Dow, "that the flexible opportunities I have pointed out for tying stations together with any degree of linking should indicate that no more reserve capacity is required than in a system that is closely interconnected all of the time. Even if more reserve capacity were required, it is not so expensive to provide as many people think. The cheapest form of reserve generating capacity obtainable is provided in an oversize generator driven by a turbine with a manual-control bypass valve admitting high-pressure steam to an intermediate stage, safeguarded by the rendering service, and if spending this money produces more reliable service, it is an inexpensive way of securing better public relations.

"My biggest problem as manager," interpolated Mr. Dow, "is to solve from year to year and sometimes from day to day the question, 'What is the desirable percentage of reliability, 100 per cent or some lower figure?' In other words, what is the proper compromise between the cost of service to obtain complete continuity and that acceptability of service which is good enough for the user? It is a difficult problem. Its correct solution differs from season to season, and I am obliged to strike a balance of all the varying figures."

"What advantages have you gained by the application



METHOD OF LOOSE-LINKING DETROIT EDISON POWER STATIONS

governor, of course. Normally the unit would be operated with the bypass closed and at maximum efficiency, but in an emergency the bypass can be opened and the furnace fires crowded by thinning up the feed and increasing the blast. The economy during emergency operation would be reduced, but this would be more than offset by the saving in fixed charges on reserve capacity furnished in the usual way.

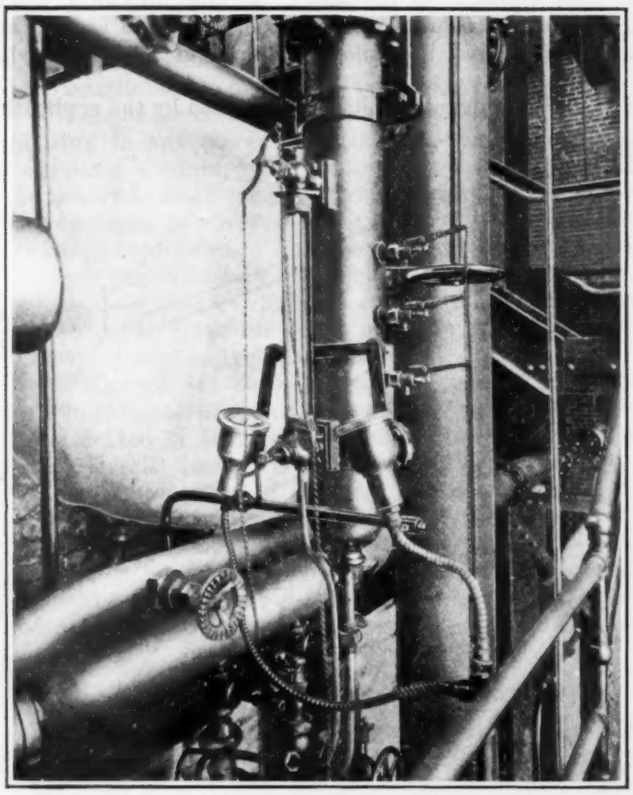
"Regardless of the foregoing, engineers have got to the point where they are worrying too much over fixed charges when spending a little more than is technically economical may mean the difference between a desirable service and a merely satisfactory, or poor, service. Five per cent increase in capital invested in a power house would hardly be noticeable in the cost of

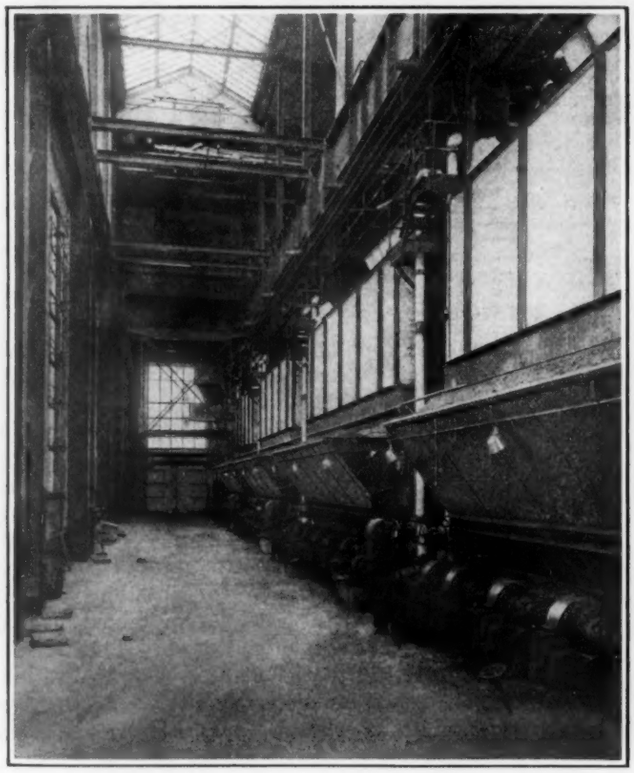
of this loose-linking method?" Mr. Dow was asked, and to which he replied: "Greater reliability and stability of operation than we obtained five years ago despite the fact that loads have increased in size and number and generating capacity has been augmented by two large stations—namely, Marysville and Trenton Channel. What greater benefits can be expected than increased reliability, on which public good will so definitely depends? In addition, we have minimized circuit breaker duties and consequently the possibility of circuit breaker failure, with possible equipment damage and most certain service interruption. Short-circuit currents were getting to the point where no available circuit breakers could handle them safely. Some means had to be established whereby available circuit break-

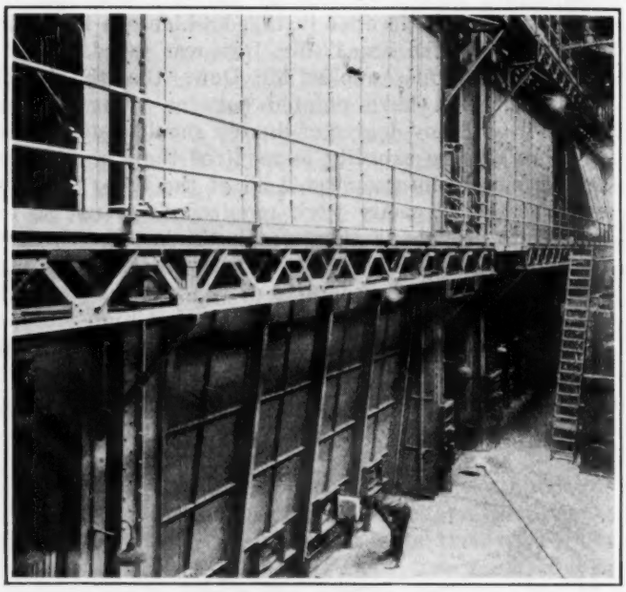
Some Good Examples of Boiler Room Lighting

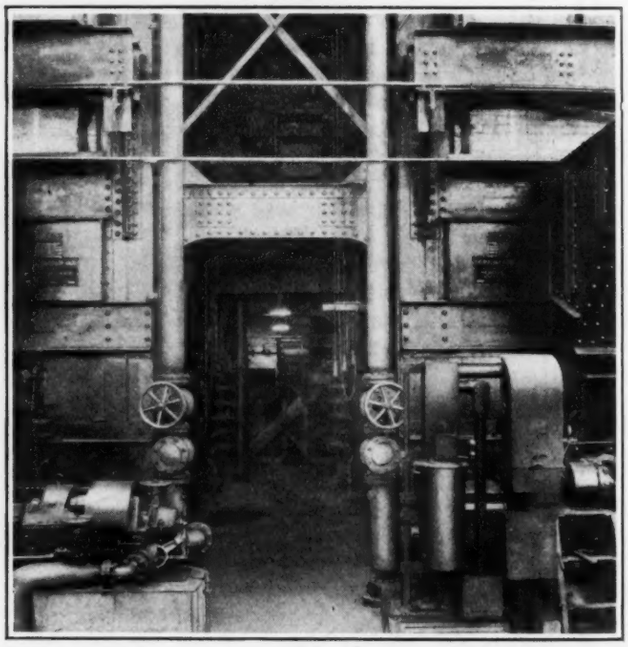
Directly below is a National water column illuminator. Below that is a boiler aisle showing the illumination of stoker mechanism by means of angle reflectors in a Hartford Electric Light Company plant (Stone & Webster, engineers).

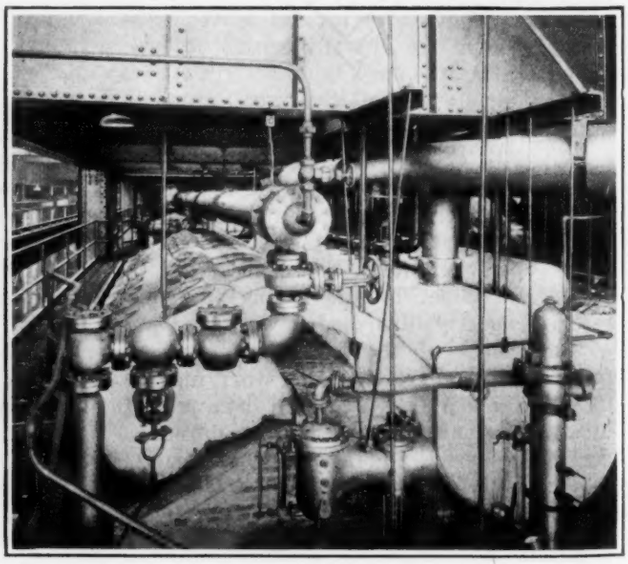
At the right are some examples of illumination in plants using oil and pulverized coal. The top picture shows the lighting in the rear of boilers in the Colfax power station of the Duquesne Light Company, Pittsburgh (Dwight P. Robinson, engineer). The others show an aisle between boilers and the top of a boiler in the Hartford company's station.











ers would have some factor of safety. The present sustained short-circuit currents to any point of the system are limited to much lower values than formerly. In substations the reductions vary from 15 to 55 per cent below the former values. At Delray the reduction has been 38 per cent and at Connors Creek about 29 per cent with a closed ring bus, 41 per cent with a sectionalized bus. The reduction in the current during short circuit, even though the circuit breakers disconnect the trouble promptly, also means lighter bumps on the system and less disturbance of the connected synchronous machinery. With partial separation, these bumps are confined more to one generating plant and its area and are not so keenly felt in the other areas. In the event of an extremely bad shakeup or possibly even a shutdown in one of the generating systems, this system will be automatically separated from the contiguous systems by the opening of the existing interlinkages, without serious disturbance or possible shutdown of the entire system. Isolation of trouble and prevention of promiscuous secondary disturbances enable a better diagnosis and a quicker recovery to normal operation."

For the benefit of other companies, Mr. Dow was asked whether loose-linking could be advantageously applied to any other growing system and whether the application would limit the location and size of plants. He replied: "I do not contend that loose-linking supplants the necessity of reactors or other equipment or methods that may be adopted. Further, I recognize the desirability of greater certainty of relay action than is now obtainable. Nevertheless, I confidently believe that loose-linking, whether it is called by that name or not, can be applied to any concentrated power system or to any interconnection of large power sources with benefits equal to those we have obtained. The location of the plant and its size are less restricted with loose-linking than with solid interconnection.

Modern Lighting for Power Plants

Discussion of Fixtures, Intensities and Illumination Requirements for Power Houses—New Units Developed for Special Needs — Reliability and Maintenance Accented

By DAVIS H. TUCK
Electrical Engineer the Holophane Company

THE illumination of steam and hydro power-generating plants, substations and rotary converter stations presents many special problems from electrical, mechanical and structural standpoints. There are extremely high rooms, low rooms, clean spaces and very dirty places, indoor space and outdoor space, places where very fine work is done and other space used for storage purposes. Due to this variety of types of space to be lighted and special conditions surrounding each location, it has been found in practice that it is impractical to attempt to use one type of lighting unit as standard throughout the plant. Maximum utilization efficiency and reliability of service can be obtained only when specific lighting equipment especially designed to meet the individual requirement is employed. Instead, therefore, of having a standard reflector for lighting power plants, there is a standard method of lighting each location in a power plant.

Power plant design has become standardized to the point where similar locations in different plants are very much alike as far as those conditions that will determine the lighting is concerned. It is therefore practical to treat locations common to all generating stations as a standard condition. The three outstanding features of all lighting equipment used in a generating station or substation are: 1. Reliability of operation. 2. Efficiency of utilization. 3. Ease of maintenance.

The intensity of illumination provided for the different locations will vary according to service. It should be realized, however, that the intensity for repair and inspection work will be greater than the intensity required for routine operation, and the installation should be planned for the maximum rather than the minimum demand. In general, liberal provision for trouble lamps should be made to facilitate repair work.

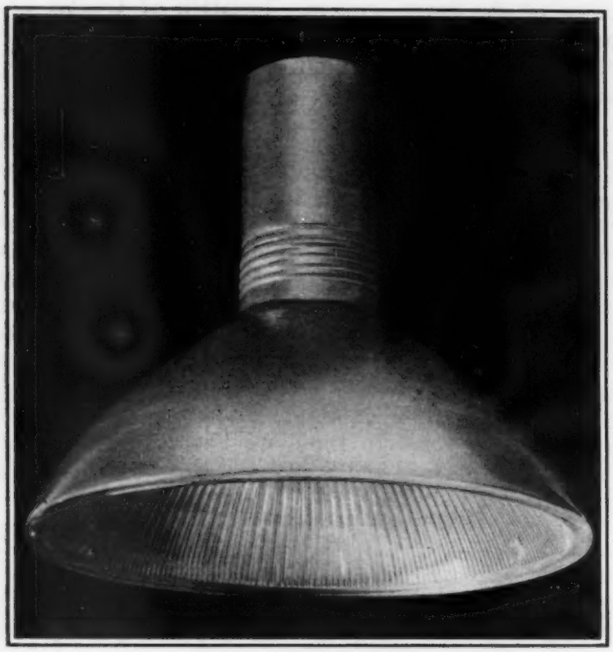
Since the lighting of a power station is prone to failure at just the time when trouble is being experienced at the station and it is at such times that light is most urgently required, it is of utmost importance that an adequate system of emergency lighting be provided. The capacity of the standby battery should be sufficient to carry the entire emergency load for an hour.

The most satisfactory manner of arranging the emergency lighting system is to install the emergency system as a part of the normal system to be burned from the normal energy supply, but which in case of emergency is automatically switched on to the storage battery stand-by.

Yards, Roadways, Coal Pile, Exterior Coal and Ash Handling Equipment

The illumination of the yards, roadways, coal pile and exterior ash and coal-handling equipment present much the same problem as do similar locations in the average industrial plant. Experience gained during the World War in this work indicates that the only two methods of yard lighting worthy of consideration were: (a) Flood lighting with projectors; (b) uniform lighting with refractors.

The flood-lighting system is usually less expensive to install and more accessible for maintenance but its light characteristics are not the best. It is of special value where a relatively small area is to be brightly lighted and where poles or brackets on buildings are not advisable.



UNIT FOR FIRING AISLE ILLUMINATION

The holder and dust cover is one piece of spun aluminum and the prismatic reflector screws into the metal holder. The male thread is molded in the glass and the female thread is rolled in the aluminum fitter. It uses a 200-watt lamp.

The refractor units are of value where it is desired to illuminate the yard uniformly. There are a wide variety of distributions possible. In addition to the variety of horizontal distribution types, the angle of maximum candlepower of any one reflector type may be made to occur at any point between 65 and 80 deg. by adjusting the lamp position vertically.

EXTERIOR INTENSITIES

The illumination intensities for exterior lighting vary from 0.75 foot-candle for unloading and conveying coal to 0.25 foot-candle for roadways and other parts of the yards.

The coal crushing and conveying equipment and the coal bunkers are the dirtiest places in the plants and it is fortunate that the work done there does not require high-intensity illumination. It is common practice to use bare lamps for the illumination of these spaces, but RLM reflectors with clear vapor-proof globes give better utilization efficiency and a more uniform illumination. It is essential that the lighting units be hung low and easily accessible.

An illumination intensity of 3 foot-candles is recommended for crusher, conveyor and bunkers and it will require approximately one watt per square foot. The emergency system should constitute approximately 15 per cent of the whole.

FIRING AISLES IN BOILER ROOM

The type of illumination of the firing aisle will depend on whether coal or pulverized fuel or oil is used for fuel. If coal is used, the firing aisle has the typical construction shown in the illustration on page 142. For this construction it is necessary to mount the lighting units at a height of 40 ft. or more above the floor. For this service the extreme intensive type of light distribution is required. The illustration at the left shows the type of reflector.

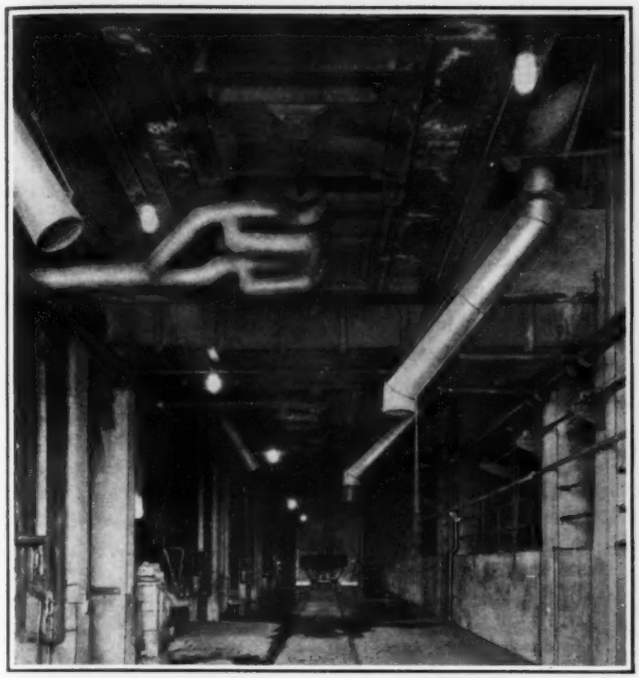
The general illumination in the firing aisle should be 3 foot-candles. This intensity will be obtained if the units are mounted on 25-ft. centers. The emergency system should constitute one-third of the total general lighting system.

In addition to the general illumination of the firing aisle, local lighting will be required for the water columns, steam gages and stokers and drive mechanisms. A splendid method of illuminating the water column is by means of the National water column illuminator shown in the illustration on page 142.

The height of the water column is made visible by the mirror action of the meniscus. The steam gage, indicators and clock should also be lighted with the water column illuminators. These illuminators give two beams of light from two 40-watt lamps focused

COAL CONVEYOR OVER BUNKERS

Use of RLM reflectors by the Edison Electric Illuminating Company of Boston to light this part of a power plant.



ASH ROOM ILLUMINATION. CLEAR VAPOR-PROOF GLOBES ARE USED BY THE HARTFORD ELECTRIC LIGHT COMPANY

ILLUMINATION OF TURBINE ROOM IN HARTFORD ELECTRIC LIGHT COMPANY PLANT USING HIGH MOUNTING UNITS

by lenses to fall on the meniscus of the water column and cause it to glow so that it can be readily seen from any part of the firing aisle. A series of small holes on the casing around each lens are arranged for connection to the station compressed air system or to the forced air draft, and the streams of air effectively prevent the accumulation of dust on the lenses. The device has always demonstrated a striking ability to withstand water glass explosions due to its rugged construction and to the special heat-resisting quality of the lens.*

The stoker mechanism will require local illumination. Angle type porcelain enamel steel reflectors with 75-watt lamps are suspended from the coal hoppers as shown in the illustration on page 142.

Pulverized Coal and Oil Burning Boiler Plants

The firing aisle in boiler plants using pulverized coal and oil as a fuel differs greatly from those where crushed coal is used. The ceiling height is low and the illumination required is of the general type. RLM reflectors are best suited for the purpose. An illumination intensity of 2 foot-candles is required and it will be adequately supplied by the provision of 0.4 watt per square foot.

Illumination is required over, at the rear and between boilers for inspection and operation of valves, stoker dines, etc. RLM reflectors with 100-watt lamps are satisfactory for this service. An illumination intensity of 2 foot-candles should be available and one-half of the system should be on the emergency system.

When lights are placed over boilers, care should be taken that the units be hung far back and low enough so that they cannot be seen from the firing aisle, otherwise the glare from these units will interfere with the boiler gage and water column illumination.

*From a paper entitled "Salient Features in Power Station Lighting," by Raymond A. Hopkins, engineer, Stone & Webster, Inc., Boston, Mass. *Transactions* of the Illuminating Engineering Society, No. 9, Vol. 18, page 810.

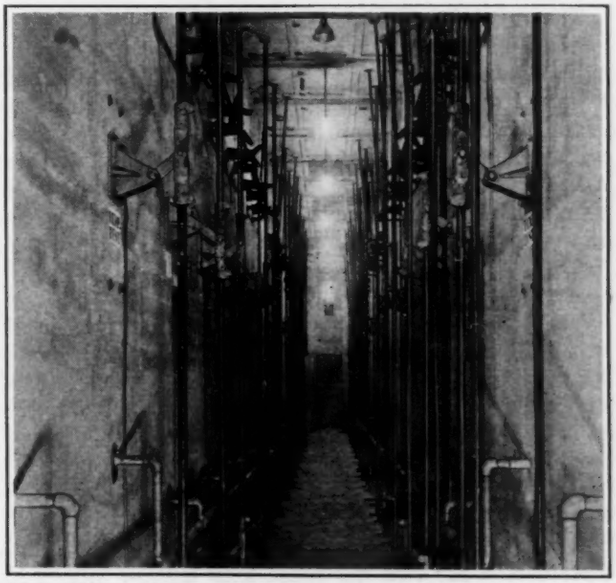
The work done in the ash rooms is of a rough nature, requiring no close work, and a certain amount of glare can be tolerated. Due to steam and acid conditions, the vapor-proof type of fixture should be used.

Turbine Room Illumination

The lighting of the turbine room is the most important illumination problem in the entire power plant. This room is the largest single interior space in the plant and is the part most often seen by the public.

There are three methods usually employed to illuminate the turbine room: (1) Overhead system. (2) Brackets on the pilasters. (3) Angle type reflectors mounted on the pilasters.

The bracket type of illumination is inadequate when



AISLE LIGHTING

In a station of the Edison Electric Illuminating Company of Boston. Special asymmetric lighting units

used alone and if employed for architectural considerations should be supplemented by overhead illumination.

The system employing angle type reflectors mounted on the side walls gives good foot-candle results, but has several serious disadvantages, as follows: (a) The glare produced is quite objectionable. (b) Long unnatural shadows are formed. (c) The upper portion of the room is left in comparative darkness. (d) If a balcony is used for switching or other operations, the angle type reflectors are objectionable because they are in the direct line of vision.

Hence it will be seen that the overhead system of illumination is the correct method. The particular type of lighting unit to be used should have the qualities of (a) intensive type of light distribution giving high utilization efficiency when mounted high over the craneway; (b) upper component of light to give a cheerful daylight appearance of the turbine room; (c) depreciation due to dust and dirt to be minimum.

The illumination intensity required for routine operation is 6 foot-candles. However, the lighting system should be designed to give 10 to 15 foot-candles, so that adequate intensity can be secured for work during construction and breakdown. An emergency lighting system to produce a fairly uniform illumination of 2 foot-candles should be included.

Condenser Floor Uses Overhead Lighting

The condenser valves, pumps and other apparatus auxiliary to the turbine are usually placed under the turbine room. Such apparatus must be lighted from above and the reflectors should be suspended to clear the pipes and other obstacles on the ceiling. RLM reflectors should be used, and it is recommended that these be suspended from Crouse-Hinds U.N.J. ball joints to allow flexibility. The luminous top RLM reflectors are to be preferred because of the upward component of light. An illumination intensity of 4 foot-candles should be provided. The emergency lighting system should constitute 20 per cent of the total, and also generous provision for convenience outlets should be made.

The storage battery room requires acid-proof lighting and switching equipment. Glass-inclosed fixtures are suitable, and these should be used with Veco aluminum fittings if open conduit is used or cast-iron fittings cast in the concrete if conduit is not exposed. The walls and ceiling should be finished with white acid-resisting paint. An illumination intensity of 5 foot-candles should be provided. The emergency lighting should be 25 per cent of the total.

Aisles, Corridors and Passageways

The switch room is typical of several areas in the station, such as cable room, bus room and similar spaces where apparatus is arranged on either side of narrow aisles. These spaces require good illumination, as not only must disconnect switches be manually operated but breaker mechanisms and the labels over compartments must be clearly visible. Generous provision should be made for convenience outlets.

Recently an asymmetric unit giving an ideal light distribution for lighting these long narrow spaces has been developed. This unit should be spaced on centers not to exceed 2.5 times the mounting height and should be equipped with 100 or 150-watt lamps. The light distribution is extensive along the aisle and intensive across the aisle, so that uniform horizontal and vertical illumination will be received. Rigid suspensions should be used, so that the unit will not turn about its axis. An illumination intensity on a horizontal plane of 5 foot-candles should be provided. The emergency lighting in the switchroom should constitute 20 per cent of the total and in other passageways 50 per cent.

Switchboard Room Requirements

The switchboard room illumination should be most carefully considered because of the reflected images of the light sources that are apt to occur on the glass instrument faces. There are two satisfactory methods of lighting switchboard rooms: (1) Totally indirect lighting provided by visible units. (2) Totally indirect lighting provided by cove lighting. All other methods of lighting give most undesirable images in the glass meter faces. An illumination intensity of 10 foot-candles should be provided. The emergency system of lighting should constitute 30 per cent of the whole.

TABLE I—SUMMARY OF LIGHTING REQUIREMENTS OF THE VARIOUS SPACES IN A POWER PLANT

Location	Intensity, Foot-Candles	Per Cent Emergency Lighting	Type of Unit	Manufacturer
Yards, roadways, coal pile	0.25	None	Flood light or refractor	Crouse-Hinds G. E. X-Ray Holophane Co.
Exterior coal and ash handling equipment	0.75	None	Flood light or refractor	Crouse-Hinds G. E. X-Ray Holophane Co.
Coal crushing and conveying equipment and coal bunkers inside of plant	3	15	RLM vapor-proof type	Benjamin Ivanhoe Westinghouse
Firing aisles, crushed coal	3	33	Special reflectors No. 657	Holophane Co.
Firing aisle, pulverized coal and oil	2	33	RLM	Benjamin Ivanhoe Westinghouse
Water column steam gages, etc.	....	..	Special illuminator	National Co.
Stoker mechanism	2	33	Angle steel reflector	Benjamin
Over rear and between boilers	2	50	RLM	Benjamin Ivanhoe Westinghouse
Ash room	1	25	Veco VP-16	Veco Company
Turbine room	15	15	Special No. 661-A1	Holophane Co.
Condenser floor	4	20	RLM	Benjamin Ivanhoe Westinghouse
Battery room	5	25	Vapor-proof refl. globes	Veco Company Holophane Co.
Switch room	5	20	Spec. asym. C-2172	Holophane Co.
Switchboard room	10	30	Total Indirect	Holophane Co. X-Ray Co. Wheeler Co.
Corridors	2	50	Spec. asym. C-2172	Holophane Co.

First Automatic Substation in France

WHAT is said to be the first automatic transformer station in France has recently been installed by the Compagnie Française Thomson-Houston at Sèvres for the Société des Transports en Commun de la Région Parisienne. The equipment comprises three 550-kva., 13,500/445-volt transformers and two six-phase, 500-kw., 600-volt converters.

Cincinnati's Load-Building Record

Ninety Thousand Residences Connected to Lines of Union Gas & Electric Company by Organized Selling—Details of Wiring Campaign—Power Load Also Built Up—Large Appliance Merchandising Operation

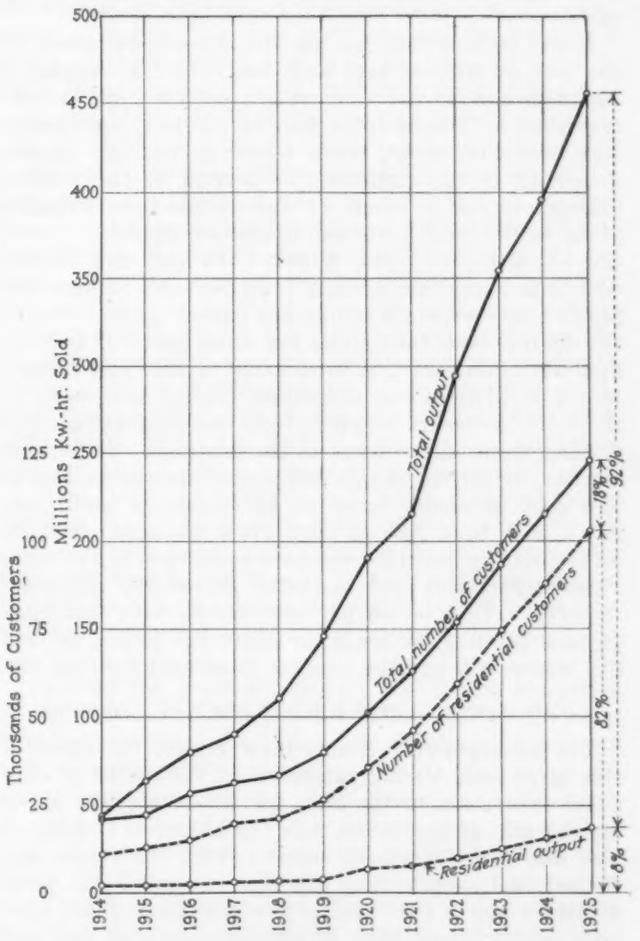
THE cutting in a few weeks ago of the new Columbia power station on the Ohio River just west of Cincinnati, which has made available 80,000 kw. of additional capacity on the system of the Union Gas & Electric Company of Cincinnati, comes as the result of one of the most notable achievements in central-station load building that the industry has seen. Twelve years ago, when W. W. Freeman, now president, became responsible for the electrical department of the company, there were on the system 9,697 residence consumers, 8,365 commercial lighting customers, 2,258 small power installations and six large power accounts, a total of 20,326 consumers. Today the number has increased to roughly 100,000 residence, 18,000 commercial lighting, 4,000 small power and 496 large power customers, a total of 122,496 consumers, with an increase in peak load from 19,500 kw. in 1913 to an estimated 150,000 kw. today. Since Jan. 1, 1921, and up to Nov. 1, 1925, by highly organized selling effort 81,811 homes have been wired in Cincinnati and connected to the lines, and the story of this development is remarkable.

It must be remembered that Cincinnati is an old and very conservative city, which for many years has shown practically no growth. It is served with natural gas at very low rates and there was so strong prejudice for gas that few new residences were lighted electrically. It was necessary therefore to proceed systematically to build up a general public acceptance of electric light as well as actually to secure consumers. As a first step in the campaign of selling certain homes were selected and wired in various parts of the city and then used for demonstration, the people of the neighborhood being invited to inspect them. This aroused much interest, but produced few contracts. Later several selling campaigns were begun and other promising sales methods developed by companies elsewhere were tried. Nevertheless conservative Cincinnati responded very slowly.

Free Trial Wiring

Finally just before America entered the war a radical innovation was introduced in an offer to wire houses on trial—30 days of free trial—the company agreeing to remove all wiring and restore gas fixtures and put the house in its original condition if the customer desired, or to sell the installation on deferred payments, the work being done by local contractors, financed by the company. Then the war stopped all this, of course, and it was the beginning of 1921 before capacity was available and the company was organized and ready to renew the attack.

Meanwhile, S. D. Heed became general manager of the Union company, instructed to carry forward for Mr. Freeman a program of market development that it was hoped would bring Cincinnati up to date electrically. The first move was to create a large staff of salesmen. The Union Gas & Electric Company at that time was not in the merchandising business, having sold its appliance business some time before, and it did no wiring. When the plans were made for a high-pressure wiring campaign, the local contractors were unwilling to go ahead with the established schedule of prices, all but the proprietor of the Gas & Electric Appliance Corporation, which had formerly been the company store. This man offered to take all the wiring work at the old figure, and it was decided to go ahead. A staff of 25 house-wiring salesmen was recruited and began a house-to-house canvass, and the business came so fast that the company before long decided to buy back the appliance corporation in order to insure an adequate organized appliance follow-up. With it came a force of 125 wire men.



GROWTH OF LOAD

Comparison of increase in number of customers and growth of load on lines of Union Gas & Electric Company

This move was, of course, unpopular with the local contractors, but the company felt impelled to provide for the needs of the campaign and Mr. Heed went

frankly to the contractors, told them his plans and prophesied to them that this activity would increase their own business beyond anything they had experienced and, by increasing the use of electricity in Cincinnati, would bring them greatly enlarged prosperity. All wiring contracts in excess of the capacity of the company's crew were to be turned over to the contractors.

CAMPAIGN SELLING

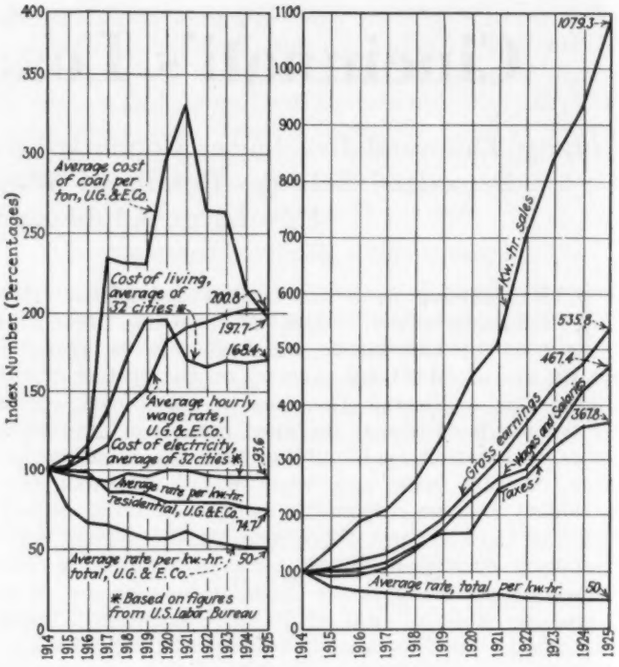
At that time there were on the lines of the Union company 44,000 wired homes, with a population of 550,000. The city was districted. An intensive campaign of advertising was begun and the house-to-house sales drive was maintained day after day without abatement, highly organized with morning meetings, crew managers and all the other devices of such selling. The record of contracts taken is shown in the accompanying table.

It will be seen that for the first three years about 60 per cent of all contracts were taken by the company's salesmen and 40 per cent were received from outside contractors. The business done by the local contractors was increased about seven times during the period, according to the testimony of several of the leading contractors, as a result of the tremendous stimulus given to the public interest in electric lighting. Since the beginning of 1924, however, 55 per cent of the contracts have been coming from outside, because the peak of the company's selling has passed. In fact, the entire selling crew, then under the direction of T. L. Phillips, were taken off this work early in 1924 and thrown into a security-selling campaign, calling once more on their old customers to whom they had sold wiring, and making them stockholders in the business. These men worked exclusively on this assignment for eleven months and sold an entire issue of $5,000,000 of securities. Since that time part of this crew has gone back to selling wiring and the rest have continued in the securities department and marketed $3,000,000 additional in stock. This is 6.6 per cent stock, with dividends payable monthly, 55 cents per share per month, so that five shares will pay the average household lighting bill.

COMPARATIVE CURVES SHOW EFFECT OF CAMPAIGN

The accompanying charts show vividly the effect of this large-scale wiring campaign on the status of electrical saturation in the city, for while this was going on, the sale of appliances into the homes of Cincinnati also was given intensive support, with the result that the original electric shop has been expanded into seven appliance stores that during the past three years have been selling more than $2,000,000 worth of gas and electric appliances annually. Correspondingly active work was also concentrated on industrial power development, and a total station load of 65,000 kw. at the beginning of 1921 became 112,000 kw. on Jan. 1, 1924, and has today reached a high point of 137,000 kw., with a growth of kilowatt-hours sold from 190,000,000 annually to approximately 500,000,000 in the same period.

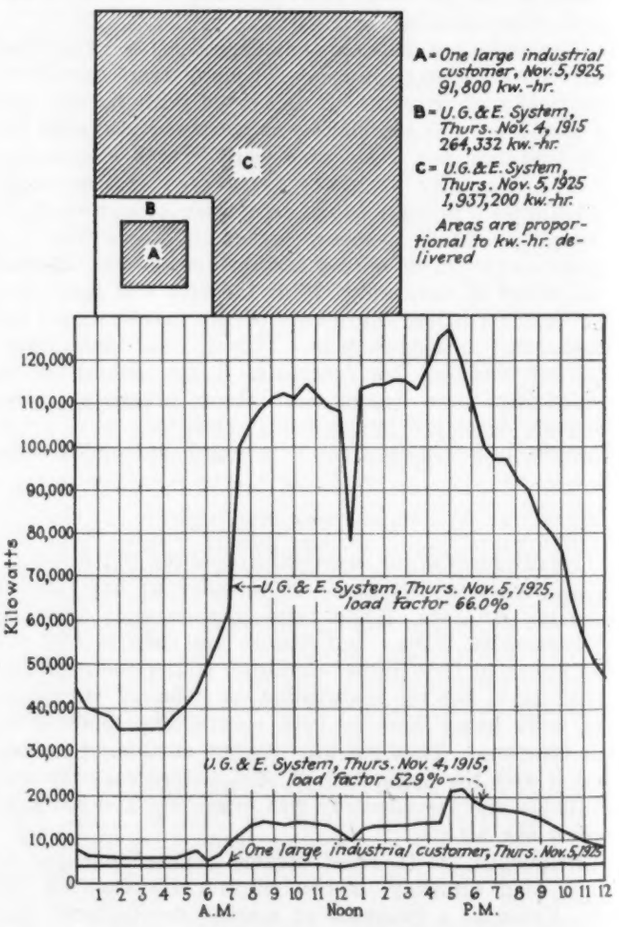
During this period also the sales for electric service were reduced very materially; in fact, as the curve shows, the average rate per kilowatt-hour on residence service in Cincinnati, taking the rate in 1914 as 100, stands today at 74.7 and the average rate on the total kilowatt-hour sales at 50. And this is particularly striking when it is considered that a similar compari-



COSTS, EARNINGS AND RATES

The curve at the left shows how, since 1914, the average rate per kilowatt-hour of electrical energy has decreased one-half, while the wage rate has doubled and the cost of living has increased two-thirds.

At the right, the decrease in rate per kilowatt-hour is compared with the increases in taxes and wages and salaries and the total sales of over 1,000 per cent increase with the gross earnings of only 536 per cent enlargement.


A = One large industrial customer, Nov. 5, 1925, 91,800 kw.-hr.
B = U.G.&E. System, Thurs. Nov. 4, 1915 264,332 kw.-hr.
C = U.G.&E. System, Thurs. Nov. 5, 1925 1,937,200 kw.-hr.
Areas are proportional to kw.-hr. delivered
Kilowatts
U.G.&E. System, Thurs. Nov. 5, 1925, load factor 66.0%
U.G.&E. System, Thurs. Nov. 4, 1915, load factor 52.9%
One large industrial customer, Thurs. Nov. 5, 1925
A.M.
Noon
P.M.

COMPARISON OF LOADS

Daily load curve comparison, 1915 with 1925, showing influence of one large customer

son with other costs, rated in 1914 as 100, shows today wages and salaries at 467.4 and taxes 367.8, wages 200.8, coal 197.7 and the general cost of living based on the U. S. Department of Labor figures taken from 32 cities, 168.4.

Selling Plan

This entire achievement has been the product of highly organized selling, consistently maintained over a long period. S. D. Heed, for the last year or more vice-president of the Union Gas & Electric Company, under whose leadership these campaigns have been carried out, says: "The problem of residence wiring resolved itself into a straightforward selling job, and any selling job can be planned just as definitely as any engineering enterprise and results will follow just as logical and unfailing laws. Our plan of action can be stated briefly as follows:

"1. Definite policy of fair competition and aggressive leadership.

"2. Complete survey of possibilities.

"3. Card record of all prospects.

"4. Division of territory into small districts for salesmen.

"5. Map record of each district, showing wired and unwired homes.

"6. Yearly quota for sales department.

"7. Monthly quota for each salesman.

"8. Graduated commissions to encourage quantity production.

"9. Bonus for obtaining monthly quota.

"10. Additional salesmen in supposedly poor months (but there were no poor months).

"11. Closely supervised sales force to keep men on their toes and get the name on the dotted line."

NEW CUSTOMERS SECURED

1921, Month	Contracts Taken by Company Salesmen	Contracts Received from Outside	Total New Residence Customers
January	211	335	546
February	707	375	1,082
March	705	543	1,248
April	636	579	1,215
May	518	576	1,094
June	583	462	1,045
July	645	486	1,131
August	679	559	1,238
September	650	664	1,314
October	635	523	1,158
November	857	674	1,531
December	720	530	1,250
	7,546	6,306	13,852
1922			
January	359	603	962
February	658	598	1,256
March	900	730	1,630
April	911	743	1,654
May	660	867	1,527
June	1,605	780	2,385
July	661	650	1,311
August	709	875	1,584
September	1,021	845	1,866
October	1,147	1,029	2,176
November	1,609	894	2,503
December	1,165	701	1,866
	11,405	9,315	20,720
1923			
January	669	663	1,332
February	810	640	1,450
March	1,504	1,006	2,510
April	1,091	912	2,003
May	849	996	1,845
June	1,604	834	2,438
July	667	754	1,421
August	546	996	1,542
September	1,030	970	2,000
October	838	1,120	1,958
November	1,305	1,020	2,325
December	832	551	1,383
	11,745	10,462	22,207
1924			
January	200	539	739
February	675	645	1,320
March	596	843	1,439
April	701	790	1,491
May	620	1,005	1,625
June	461	725	1,186
July	560	474	1,034
August	531	522	1,053
September	520	460	980
October	525	460	985
November	516	412	928
December	414	625	1,039
	6,319	7,500	13,819
1925			
January	315	471	786
February	475	465	940
March	659	596	1,255
April	545	754	1,299
May	554	850	1,404
June	412	536	948
July	435	565	1,000
August	466	584	1,050
September	439	629	1,068
October	487	976	1,463
	4,787	6,426	11,213
Totals	41,802	40,009	81,811

Cost and Influence

The cost of securing this new residence business is an interesting evidence of the effectiveness of this campaign. During the year 1921 the cost per contract taken by the company was $5.13 and the cost per contract for all business taken, including those taken outside, was $2.80. In 1922 the cost on company contracts was $4.74 and for the total $2.61 per contract, which continued to be the approximate cost of securing this business. Naturally, good men were needed to keep the pace and the selling force was organized on a liberal commission basis that insured safe handling of customer contracts and an income sufficient to hold the trained men. In the month of June, 1921, for example, the average income of the salesmen was $143, and the highest earned by any man $280. As the campaign developed the best salesmen ran up their earning power until monthly payments appear on the records as $424, $625, $587, $923 and $959. The entire crew were running higher and the average income for the month of June, 1922, was $512, and 1,605 contracts were brought in by these men that month. The average income for the entire year 1923 for the entire crew was $225 per month per man. The best salesmen proved to be men who had never sold anything at all before, but who had been trained in the crew for this particular job.

Perhaps the happiest note of the entire campaign, however, was the benefits that have come in the relationships between the Union Gas & Electric Company and the local electrical trade. In the beginning the contractors and dealers were naturally very much alarmed. Soon after the campaign was begun they appointed a grievance committee to take up some supposed indiscretions of company salesmen. The matter was investigated and the entire policy of the company in this activity was carefully studied, and as a result the committee was dismissed. The improvement in electrical trade conditions has been so marked that the sentiment toward the company has steadily sweetened. It is doubtful if there is any city in the country today where a higher degree of constructive co-operation exists between the central station and the other branches of the local electrical industry than in Cincinnati.

Contractor-dealers and jobbers have clearly seen that the load-building campaign has brought the electrical market in Cincinnati to life and that they are naturally profiting greatly from the increased volume that flows to them under the new conditions. They urge that this could have been brought about only by strong leadership and highly organized selling.

Letters from Our Readers

Central-Station Service Versus Private Plants in Hotels

To the Editor of the ELECTRICAL WORLD:

In your issue of Nov. 14 (page 991) appears a very interesting and valuable article under the caption "Selling Power to Hotels." I am in accord with many of the statements made in the article, particularly those relating to the important bearing that the value of floor space has on a decision relative to the supply of power.

No doubt many of your readers were surprised by the savings which were effected in the Sherman Hotel by changing from a high-pressure to a low-pressure plant. While it is unwise to generalize because of the many different conditions which obtain in power plants, we have found that important savings result from the elimination of steam-driven auxiliaries and their replacement by motor-driven equipment. In fact, in order to obtain the best results from purchasing service such changes in equipment must be made. I have known several cases where owners were disappointed over the results of purchasing power because no changes were made in steam equipment, with the result that large fixed losses continued even though the generating equipment was shut down. Unless plants are put on the proper basis to benefit by the purchase of power, the shutdown of the generating equipment will not result in the anticipated savings.

My experience in the analysis of power costs leads me to disagree with the following generalization which appears in your article: "The conclusion reached by hotel managers, consulting engineers and the sales executives of large central stations is that the saving to a hotel in the purchase of power is generally equivalent to the fixed charges on a private plant and often is greater. The power bill may equal the power operating costs of the private plant, but even so there is left to the purchaser of power an amount of money equivalent to at least 15 per cent of the cost of the generating plant."

I have no doubt that the sales executives of the larger central stations have reached this conclusion and that they have been able, by good salesmanship and by emphasizing the value of floor space and other advantages of purchasing power which are difficult to evaluate in dollars and cents, to convert hotel managers to their point of view. However, it can be demonstrated in the case of a large hotel that, if floor space has only a nominal value and if other construction costs are not materially increased by the installation of a generating plant, a well-operated, efficient installation will pay an attractive return on the investment when compared with the purchase of power and the supply of steam from a boiler plant with power costing 2 cents per kilowatt-hour and coal at $5 per ton. In some of the larger cities, notably Chicago, steam as well as electrical service can sometimes be purchased. The article does not state whether or not steam from an outside source is available for the new Parker House. This is an important consideration.

I suggest to your readers that they compare your article with articles on the same subject, but with opposite conclusions, appearing in *Power* under date of Nov. 24 and in the *National Engineer* for December. The subject is not so simple as your article makes it appear. There is ample basis for the sharp difference of opinion which exists. Power rates, cost of coal and other conditions are so variable that a general conclusion is not warranted.

Whatever one's point of view may be on this subject, one fact stands out unchallenged, and that is that the sales force of the Commonwealth Edison Company has made an excellent showing. Obviously it has been made possible by shifting the emphasis from the "mathematical" to the actual benefits of central-station service.

Gates Engineering Company,
Milwaukee, Wis.

SAMUEL J. GATES,
Consulting Engineer.

A Norwegian Competitor with Zschornewitz in Load Factor

To the Editor of the ELECTRICAL WORLD:

The letter by "C. J. W." in your Nov. 21 issue (page 1055) mentions a total capacity of 140,000 kw. and a daily output of 3,000,000 kw.-hr. by the electric power station at Zschornewitz. In answer to the question whether this can be registered as a world's record I take the liberty to send you the following data concerning the largest Norwegian water-power plant:

The waterfall of Rjukan, belonging to the Norsk Hydro-Elektrisk Kvælstofaktieselskap, is now developed to a total capacity of 240,000 kw. This power plant has achieved a daily output of 5,700,000 kw.-hr. The yearly output of Rjukan power plants can be stated to be about 2,000,000,000 kw.-hr., as virtually full load of the machines can be achieved all the year.

Oslo, Norway.

T. W. NORBERGSCHEN.

Inadequate Supply of Electricity in Leipzig

THE consumption of electrical energy in the city of Leipzig is estimated to have increased sevenfold since 1914, while the war and the inflation period seriously hampered the development of the power system necessary to meet the demand. The increase in consumption of electricity has been especially rapid since the stabilization of the German currency. Thus from 1923 to 1924 consumption increased 100 per cent, and a further increase of 50 per cent was shown from 1924 to 1925. The use of electricity for lighting purposes in place of gas is constantly increasing. The city electrical works are at present installing from 1,800 to 2,000 new meters every month. The increased use of electric signs likewise causes a large demand for electrical energy.

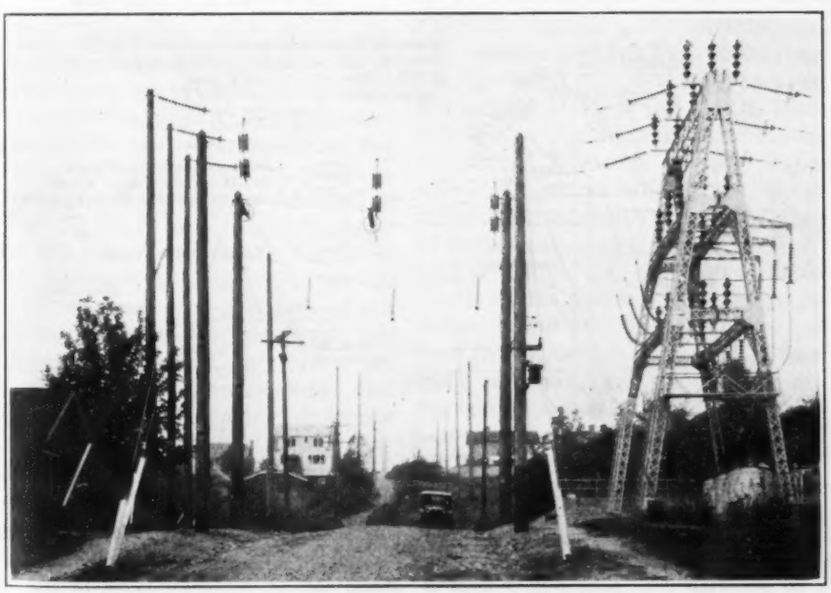
The municipal electric plant is finding it more and more difficult to supply the demand. The construction of new generating plants has been handicapped by lack of funds and also by the delays in delivery of electric machinery by German manufacturers, who are said to be overwhelmed with more orders than they can fill. Leipzig obtains the greater part of its electrical energy from the large power plant of Luchornewitz, in Prussia, which also supplies Berlin, Magdeburg and Lauterberg. This plant, which is also handicapped by delays in delivery of new machinery, is unable to increase the amount of energy supplied to Leipzig. It is expected that a shortage will be seriously felt in Leipzig unless the production capacity of the local plants can be increased. Owing to its financial situation, the city of Leipzig will be unable to carry out the necessary construction unless a loan is floated, and it is doubtful whether such a loan can be obtained on favorable terms for some time to come.

Central Station and Industrial Practice

165-Kv. Transmission Line Carried on City Street

CONFRONTED with the necessity of bringing the 165-kv. Skagit transmission line a short distance within the city limits of Seattle, the engineers on the Skagit River municipal power project resorted to the special construction shown in the accompanying illustration. It was not considered feasible to carry the circuit on a single line of poles along one side of the street, so a line of poles was set on each side of the street and the conductors were supported from span wires in a horizontal plane.

Each section was made a block long so that all the poles could be back guyed into the parking strip. The conductors are 300,000 circ. mil copper equivalent, steel core aluminum. Eleven insulator units were used for straight suspension string, are the corona shields. These shields were installed throughout the 100 miles of line and consist of a ⅛-in. circular steel plate 15 in. in diameter stamped into a saucer shape. Outside the city limits the line is supported on H-frame cedar pole structures with normal span lengths of 600 ft. and 30 ft. minimum ground clearance.



TERMINUS OF THE 165-KV. SKAGIT TRANSMISSION LINE, SHOWING THE METHOD OF CONSTRUCTION USED FOR SUPPORTING THE LINE OVER A CITY STREET

and fourteen on dead ends. On the two supports nearest the end of the line heavy iron balls were used to prevent any tendency of the conductors to rise on account of differences in elevation of the supporting poles. These are clearly shown in the picture. The devices resembling large insulator units, which may be seen just above these balls and at the conductor end of the insulator

Conductivity Tests of Wires and Cables

By H. M. Friend
Hugh L. Cooper & Company

A SIMPLE, fairly accurate and quickly computed method of measuring conductivity has been used by the writer for the past four years. On account of the increasing consideration that is now being given to cable test and inspection work numerous companies have inspectors at the cable manufacturer's plants and one of the important tests made at the plant is the conductivity test.

The reasons for making this test are as follows:

1. To check the cross-sectional area of the conductor. When the conductor is not round, but is sector shaped, some manufacturers crush some or all of the strands of wire that enter into the construction of the sector and therefore a micrometer cannot be used to gage the diameters of the individual wires. It is possible, of course, to obtain the cross-sectional area in an accurate manner by cutting a sample of the cable, straightening out the individual wires of one conductor and measuring their length and weight. Dividing the weight by the length gives the unit weight and comparing this with the copper tables shows whether the conductor is up to size or not. This is a long and tedious method and could hardly be done as a routine test on every reel of cable on account of the time and labor involved.

2. To check the length of the cable. Underground paper cable is usually ordered in manhole lengths, and serious trouble and expense are involved in case a reel of cable arrives on the job and is found to be several feet short after being pulled into a duct. By measuring the conductivity of each reel of cable, whenever it is found to run above 100 per cent, there must be either a short length, a large cross-sectional area, or copper with conductivity above 100 per cent. In practice when this occurs the reel is suspected of being short in length and it is ordered to be remeasured if the conductivity is above 102 per cent. If the length is found to be correct, it can be assumed that the cross-section of the copper is running heavy, or its conductivity over 100 per cent.

3. As a check on the purity of the copper. If the conductivity is under 100 per cent, either the reel is too long, its cross-sectional area is too small or the conductivity of the copper is low. A minimum limit of 98 per cent is usually allowed, and below this the cable is rejected. However, in practice it is rare to find copper with conductivity below 98 per cent. If the length is too great, this is not a serious defect, as the purchaser is paying for it by the foot.

A description of the simplified test method follows:

1. The resistance of the cable under test is measured. One resistance

TABLE I—RESISTANCE IN OHMS AT VARYING TEMPERATURES OF A SOLID CONDUCTOR OF SOFT ANNEALED COPPER 1,000 FT. LONG AND 1 CIRC.MIL CROSS-SECTION

Deg. C.	Ohms	Deg. C.	Ohms	Deg. C.	Ohms
0	9,553	14	10,126	28	10,698
1	9,594	15	10,167	29	10,739
2	9,635	16	10,207	30	10,780
3	9,676	17	10,248	31	10,820
4	9,717	18	10,289	32	10,862
5	9,758	19	10,330	33	10,903
6	9,798	20	10,371	34	10,944
7	9,839	21	10,412	35	10,985
8	9,880	22	10,453	36	11,025
9	9,921	23	10,494	37	11,066
10	9,962	24	10,535	38	11,107
11	10,003	25	10,576	39	11,148
12	10,044	26	10,616	40	11,189
13	10,085	27	10,657		

bridge that is much used has four leads, two voltage and two for current. A sensitive galvanometer throws a beam of light on a scale that is calibrated to read directly in ohms. The drop of potential across the cable is actually read.

2. The temperature of the cable is read by means of a mercury thermometer, reasonable care being taken to have the cable in a place of fairly uniform temperature long enough to be at the temperature of the surrounding medium. The thermometer is placed on the cable and is left there long enough to give a reliable reading.

3. From Table I, if the cable is a solid conductor, or from Table II, if the conductor is stranded, take the figures opposite the temperature of the cable on test. This figure, as described later, is based on the resistance of a rod of soft annealed copper 1,000 ft. long and with a cross-sectional area of 1 circ.mil and is derived from the International Annealed Copper Standard. To reduce this value to that of the cable under test, divide by its cross-sectional area in circular mils and multiply by its length expressed as a decimal of 1,000 ft. This now gives the theoretical value of the resistance of the cable for copper of 100 per cent conductivity. Dividing the theoretical value by the actual value, as obtained by the bridge, the per cent conductivity is obtained.

TABLE II—RESISTANCE IN OHMS AT VARYING TEMPERATURES OF STRANDED SOFT ANNEALED COPPER WIRE 1,000 FT. LONG AND 1 CIRC.MIL CROSS-SECTION

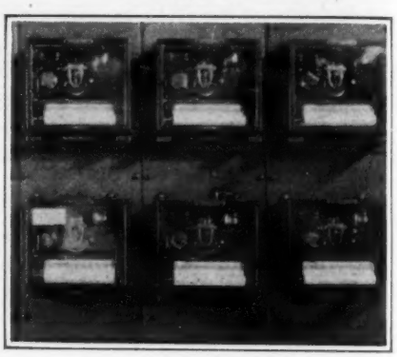
Deg. C.	Ohms	Deg. C.	Ohms	Deg. C.	Ohms
0	9,744	14	10,329	28	10,912
1	9,786	15	10,370	29	10,954
2	9,828	16	10,411	30	10,996
3	9,870	17	10,453	31	11,037
4	9,911	18	10,495	32	11,079
5	9,953	19	10,537	33	11,121
6	9,994	20	10,578	34	11,163
7	10,036	21	10,620	35	11,205
8	10,077	22	10,662	36	11,246
9	10,119	23	10,704	37	11,287
10	10,161	24	10,746	38	11,329
11	10,203	25	10,788	39	11,371
12	10,245	26	10,828	40	11,413
13	10,287	27	10,870	..	.....

The tables were derived in the following manner: From the Bureau of Standards Circular 31, on page 10, the International Annealed Copper Standard is given as 10,371 ohms per mil foot at 20 deg. C., and on page 12 appears the following: "The change of resistivity of copper per degree Centigrade is a constant independent of the temperature of reference and of the sample of copper. This resistivity-temperature constant may be taken for general purposes as 0.0409 ohm per mil foot." Therefore the figures in Table I were obtained by taking the figure 10,371 ohms per thousand mil feet and adding or subtracting the constant difference 40.9 for each degree change in temperature. Table II was worked out for concentric stranded conductor and allows an increase in resistance of 2 per cent over the solid wire. The constant difference in this case is $40.9 \times 102 - 41.7$. No allowance is made for the slight increase in length of the conductor in a multi-conductor cable due to the cabling twist, as it is much too small to be accounted in commercial tests.

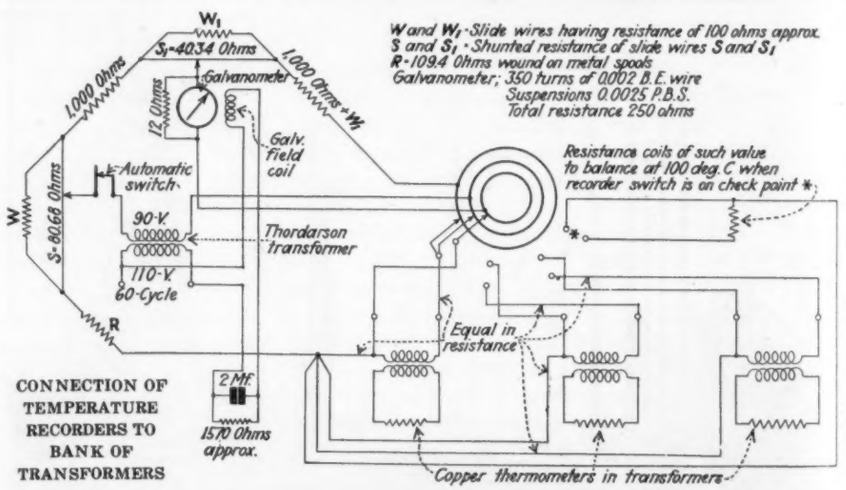
In practice it is found that this is the simplest and quickest method of measuring conductivity and for factory inspection work is sufficiently accurate. It has a slight inaccuracy due to the fact that the temperature coefficient of copper varies with the conductivity. For temperatures under 20 deg. C., the per cent conductivity will be slightly low and for temperatures above 20 deg. C. it will be slightly high. If it is remembered that the results are a fraction of 1 per cent low for lower temperatures than 20 deg. C. and a fraction of 1 per cent high for higher temperatures, then this error can be practically eliminated.

Temperature Measurement Recorders

FOR some time the Alabama Power Company has been using automatic temperature recorders on its major generating and transforming equipment. Outside of a few mechanical troubles that have been overcome, the instruments have worked very successfully and give an absolute temperature performance record of the equipment. The recorders were furnished by the Leeds & Northrup Company, and the installation at Mitchell Dam is shown in one of the accompanying illustrations.

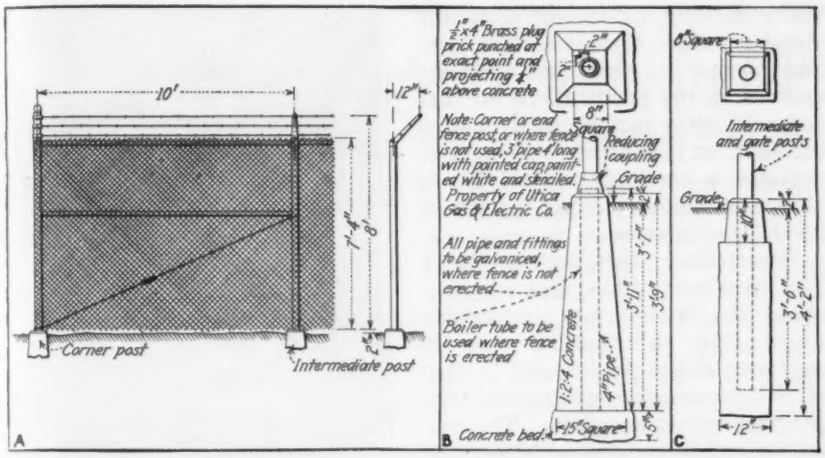


SIX AUTOMATIC TEMPERATURE RECORDERS IN USE AT MITCHELL DAM


W and W1 - Slide wires having resistance of 100 ohms approx.
S and S1 - Shunted resistance of slide wires S and S1
R - 109.4 Ohms wound on metal spools
Galvanometer; 350 turns of 0.002 B.E. wire
Suspensions 0.0025 P.B.S.
Total resistance 250 ohms
W1
S1 - 40.34 Ohms
1,000 Ohms
1,000 Ohms + W1
12 Ohms
Galvanometer
Galv. field coil
Automatic switch
90-V.
110-V.
60-Cycle
Thordarson transformer
W
S - 80.68 Ohms
R
2 Mf.
1570 Ohms approx.
Resistance coils of such value to balance at 100 deg. C. when recorder switch is on check point *
Equal in resistance
Copper thermometers in transformers

CONNECTION OF TEMPERATURE RECORDERS TO BANK OF TRANSFORMERS

At Mitchell Dam there is a recorder for each of the three 20,000-kw. generators and also for their respective transformer banks. On the generators the instrument records the temperatures of Nos. 1, 4, 5 and 6 coils, iron, lower guide bearing, incoming and outgoing air, and on the transformer it records the temperature of an inside coil of each phase. At the Gorgas steam plant the instruments are used on Nos. 1



STANDARD WIRE FENCE AND POST CONSTRUCTION USED BY THE UTICA GAS & ELECTRIC COMPANY

and 3 generators and one transformer bank. At Lock 12 one instrument is used to give the temperature of all six generators, with suitable plugging arrangements to switch from one unit to another. However, for normal operation, one coil on each machine is connected to the recorder and the other points are taken periodically. At the Huntsville substation one instrument is installed for the 110-kw. transformer bank.

The instrument itself is a self-balancing Wheatstone bridge. It consists of four distinct parts: (a) the measuring circuit or Wheatstone bridge; (b) the motor governor for driving the instrument at constant speed; (c) the automatic mechanism by which the bridge is kept balanced and the measurements are recorded, and (d) the automatic switch by which successive thermometers are connected to the terminals of the bridge. These various parts are shown in one of the accompanying illustrations. The instruments are maintained and inspected by the operating department of the company.

Standard for Wire Fence Construction

WHENEVER it is necessary to construct a fence around a substation, company-owned property, etc., the Utica (N. Y.) Gas & Electric Company follows the construction shown in the accompanying illustrations. These have been set up as standards by the company and are followed as such. In A is shown the details of the wire fence, while C and D show the corner post and intermediate post foundations respectively. B is also used as the standard property monument. In this case a 3-in. pipe 4 ft. long is used at the top of the foundation. This is covered with a pointed cap, painted white and stenciled "Property of Utica Gas & Electric Company." Concrete used in these foundations is of a 1:2:4 mixture.

Commercial Distribution Circuit Records

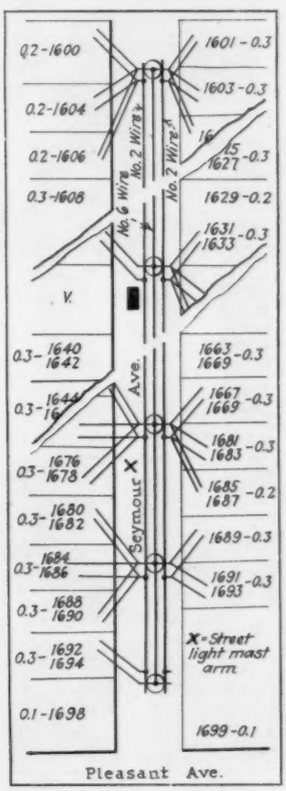
BY D. C. LEWIS
Distribution Engineer Utica Gas & Electric Company, Utica, N. Y.

THE system of distribution records that has been in successful operation for several years on the system of the Utica Gas & Electric Company consists of three essential parts. These are primary maps, secondary maps and transformer installation sheets. The preparation of such a set of records for a distribution system of any considerable size is no insignificant task, but once acquired and well maintained, it has been found possible to cut routine field work to a minimum. Following are the major items of importance covered by each of the three units of the record system.

Primary Maps. The original primary map records are made on tracing cloth 31 in. x 39 in. using a scale of 1 in. for 300 ft. for the map proper. An important feature of these maps is the drawing of street lines and the printing of street names on the reverse side of the tracing from the circuit data. This allows for erasures in connection with keeping maps up to date, without disturbing the permanent map lines. The main features shown are circuit routing, wire size, phase positions, transformer location size and reference number, tree wire, names of large customers, and location of center of distribution test box. Only three lines are used to indicate the three-phase, four-wire circuit, and one line for single-phase branches, the neutral designation being omitted, but the wire size given covers all four conductors. Mile circles are provided as a quick means of showing distances from the substation.

Secondary Maps. The most important division of the record system consists of the secondary maps that give an accurate office picture of field conditions. For every lighting transformer having more than one service there is a secondary map. Power banks feeding more than one customer are covered in the same manner. The paper used is a 10⅝-in. x 12-in. vellum sheet suitable for making blueprints from pencil tracings, all of this work being done in pencil to allow for the necessity of frequent changes and additions.

A typical secondary map layout is shown below, from which can be



PORTION OF SECONDARY MAP FOR COMMERCIAL CIRCUITS

seen, without further detailed explanation, the points found essential to the proper office control of the ordinary run of distribution work. The maps giving the property lines are secured from the city assessors' tax records, the feature of showing property lines being a big help in pole location and house numbering. It has been found that by using a scale of 1 in. for 100 ft., the sheet

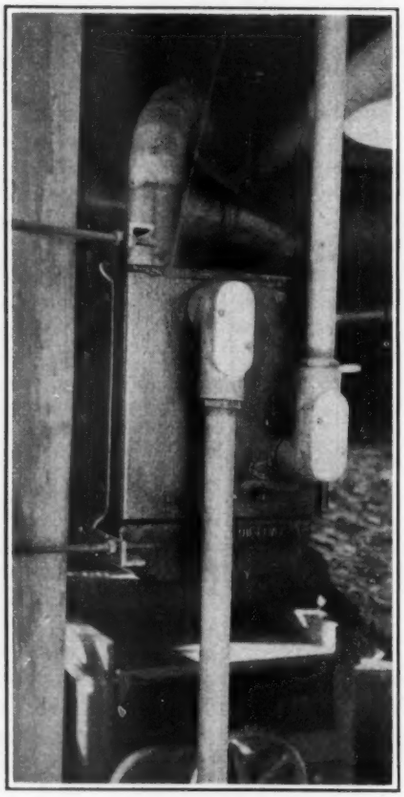
size of 10⅝ in. x 12 in. is a practical limit on the size of a secondary allowing a maximum voltage drop of 2 per cent each way from the transformer, without going to uneconomical copper sizes. In the location of transformers, corner junction poles and street lighting mast arm poles are avoided for reasons of safety and experience with frequent injury to poles at street intersections.

The load data on the maps are in the form of an assumed value for average residences, such that the values assumed allow for a diversity between houses and, under full load conditions, give a transformer loading of not greater than 125 per cent. The value allowed a residence or other type of load is given in kilowatts directly before or after the street number. Care is used in placing the map on the sheet to orient relative to the north arrow so that adjacent maps can be easily placed together, as it is often convenient to consider a territory several blocks in area in making a study for new or revised secondaries.

Transformer Installation Sheets. The third part of the office record is called the transformer installation sheet. The information recorded on these sheets is principally that of the transformer connection used and the name plate data. The connected load in the case of power customers is also recorded.

As to the filing system used, prints of the primary maps are kept on a swinging map rack, changes being noted on these prints and the original tracings brought up to date at regular intervals. The secondary maps are filed flat in a storage drawer section, all revisions and additions being made on the originals. Prints are made only when necessary for attaching to work sheets for field work. Transformer installation sheets are kept in standard 8½-in. x 11-in. three-ring note books. The main filing division is the primary circuit designation, subdivided into the circuit map reference numbers, which are identical for any installation on the primary maps, the secondary maps and the transformer installation sheets.

Convenient Mounting for Motor Starter on Column

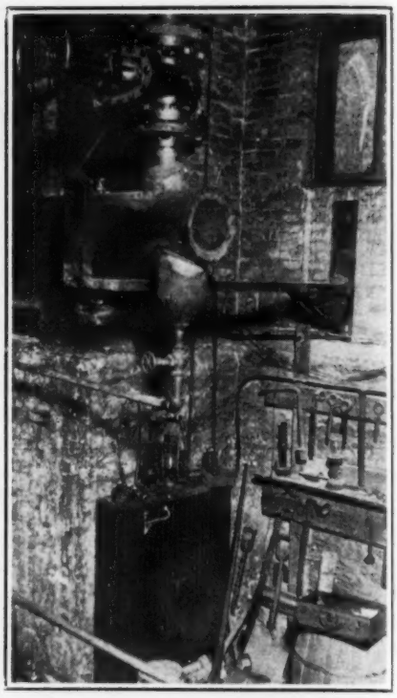


IN A MASSACHUSETTS wood mill the motor-starting boxes are conveniently attached to the reinforced-concrete columns of the shop by two ⅝-in. steel rods bolted at their four ends to 1¼-in. angles, as shown in the accompanying illustration, the angles being reversed and carrying offset ¼x1¼-in. steel straps bolted to the angles and to which the starter case is riveted. Each of the angles is fastened into the column at the center of the angle bar by a ⅝-in. expansion bolt 3 in. long. The hand-operated auto-starter illustrated serves a 15-hp. motor, both of Westinghouse make.

Welding Aids in Power Plant Maintenance

BY S. E. DOCKSTADER
American District Steam Company, Chicago

WELDED pipe joints and pipe fittings have found some use in new power stations, but another important application of welding is in the maintenance and rehabilitation of old stations that have been modernized for constant or stand-by service or for steam-heating purposes and have frequently needed considerable changes in steam-piping arrangements and other work involving cutting and reconstruction of pipe and metal work. The practice of welding has been found a great labor and material saver in this class of work. Contractors have reported many cases where the entire cost of remodeling, done by welding, did not exceed by an appreciable amount the cost alone of new fittings, flanges, bolts and erection cost where flange fittings have been used. Particular economy has been found in welding where devices such as gate valves or steam-flow meters are to be inserted in an existing steam main. Sections of pipes may be cut out and the fitting desired put in place with a minimum of expense and time.



STEAM HEADER PLUG AND WATER DRIP COMPLETELY DONE BY WELDING

The electric process of welding is frequently preferable. For example, if a steel fitting is to be welded in a pipe line, an operation that would necessitate the welding of pipe to the steel body of the fitting, the electric arc, by virtue of its instantaneous action with the least amount of heating of the surrounding material, would present the least difficulty. Other advantages are sometimes found in using the arc, such as convenience due to continuous current by which welding is accomplished and the facilities offered to get at the work, especially when it is situated overhead.

PIPE REDUCING BY MEANS OF WELDING

Commercial Activities and Public Relations

Making Managers' Meetings Effective

THE procedure to follow in holding district managers' or department heads' meetings so that the most effective results will ensue continues to be a problem of many companies. The time-honored method of starting meetings with a superior officer present has disadvantages in that it may discourage free expression of opinion. Recognizing this weakness but also the necessity of heading up such activities to secure definite results, Bert Peck, general manager of the southern Illinois division of the Illinois Power & Light Corporation, has adopted the following with desirable results.

For the first half-day that district managers assemble or the first couple of hours that department heads get together the general manager is not present. The men are required to appoint their own chairman, discuss their mutual problems and thresh out some plan of action. The absence of the superior officer leads them to express their feelings more freely. Furthermore, the responsibility of ending the preliminary meeting with a definite recommendation inspires exercise of initiative.

At the meeting following the general manager is present to hear problems and recommendations. Being relieved of sitting in on all the preliminary discussions, the general manager's time is saved, but this procedure still affords him the opportunity to express his views or modify or entirely change recommendations.

Flatiron Campaign Successful

IN AN effort to increase its monthly revenue the Rome Railway & Light Company recently carried on a flatiron campaign in which about 150 irons were sold within a period of ten days. This company serves a population of about 15,000 and has connected to its system 2,850 lighting meters, 250 power meters and 69 electric heating meters, the latter class having the benefit of lower rates for their appliance, a two-meter system being used.

Up to this time the company had not merchandised appliances, but it was thought that more irons would be sold if a little incentive was offered. Consequently, with the bills sent out on Dec. 1 there was inclosed a folder offering the customers of the company flatirons of a well-known manufacturer. The iron usually retails for about $4, and it was offered for $2.50 to those paying their bills by Dec. 10, which still enabled the company to make a small profit. By the tenth of the month practically 150 irons had been sold. It is interesting to note that these were all sold rather easily, even though more than 2,200 of the 2,850 lighting customers already had irons.

The consumption of every iron on this company's system has been found to average about 7 kw.-hr. per month, hence the irons sold during the ten-day campaign add materially to the revenue. As the sales were made by the regular office force, the campaign paid for itself.

Overcoming Sales Resistance to Industrial Electric Heating

Knowledge of Factors in Sales Resistance an Important Weapon in Breaking Down Barriers—Some Difficult Problems and How They Have Been Solved

IF EFFECTIVE methods of overcoming sales resistance to industrial electric heating are to be developed and satisfactory advancement is to be made, manufacturer and central-station representatives must know in advance all the factors involved. With this in mind, ELECTRICAL WORLD sought from manufacturers of electric heating equipment, from users and from central-station sales engineers specific and detailed information on sales resistance to industrial electric heating and methods that had proved effective in overcoming the principal obstacles.

SOME UNDERLYING CAUSES OF SALES RESISTANCE

Human Inertia—The tendency of industrial operators and even executives to cling to existing methods is reported as a common and often formidable obstacle to the adoption of industrial electric heating.

When other attempts have failed, the installation of a trial furnace is the most effective means of overcoming human inertia. Putting a furnace in on trial avoids the necessity of guaranteed performance in cases where actual operating conditions cannot be predicted. A more important advantage of the trial installation is that the user is given opportunity to overcome any prejudice to the new idea and is enabled to learn at first hand the inherent advantage of electric heat.

Prospects Hesitate to Admit Shortcomings of Existing Methods—The natural unwillingness to disclose anything that may reflect upon his ability often causes a man to refuse information on deficiencies of existing practice.

Cultivation of the prospect will in time cause him to feel more free to discuss his failures as well as his successes. If the prospect still insists that his methods are entirely satisfactory, it is sometimes possible, by inquiry among his customers, to learn significant facts about the shortcomings of his product. For example, a maker of enamel ware who would not consider electric heat insisted that he had no rejects in his production. At the same time one of this manufacturer's customers who was installing electric enameling equipment stated that the rejections of his product because of defects in the enameled parts received from the first manufacturer would pay the entire cost of operating an electric furnace on a power rate 100 per cent greater than that available to the first manufacturer.

Necessity of Selling Both Operative and Executive—Although the superintendent of an industrial heating department may be willing to alter his operating methods and take full advantage of electric heat, the

executive may prefer to invest any additional capital in another department, where even greater returns may be expected. Again, the manager of the enterprise may be sold on the possibilities of electric heat, but be unable or unwilling to override the prejudice of the departmental superintendent. An appeal to the self-interest of the individual responsible for the impassé may sometimes produce the desired result. The prejudiced superintendent may be successfully urged to accept the opportunity to effect economies, improve production and otherwise bring himself favorably before the management and without risk, as the management assumes the responsibility for the success of the venture.

Lack of Capital—This is always a serious obstacle and has forced many manufacturers against their wishes to continue with inefficient methods and equipment. Satisfactory solutions to certain cases of this kind have been the spreading of payment for the new equipment over a period of time, the central station or manufacturer, or both, assuming the financial burden. These cases generally involve manufacturing concerns whose volume of business is ample to make possible savings sufficient to pay a large part of the cost of the change within a comparatively short time.

Insufficient Volume of Business—Frequently the best design of electric furnace for a specific operation will have a production capacity several times that of the fuel-fired units replaced. The greatest economy from electric operation is realized with a continuous rate of production. If the prospect's volume of business is insufficient to make possible economical operation of the particular furnace design, the design must generally be changed to fit as closely as possible the expected required production. In some cases the lower production costs made possible by continuous operation will make possible such decreases in prices that the market and demand for production are materially increased, bringing the volume of business to a point that will justify the expenditure for the high capacity electric furnace.

Destructive Competition

Conflicting Arguments of Gas and Electric Salesmen—Unsound practices of some gas companies used in efforts to keep out electric heat may constitute a real obstacle in certain cases, but will in the end react less favorably to gas than to electricity. A more serious situation is that arising from the inability of gas and electric industrial heating specialists to agree on which service is preferable for the best interest of the customer. Disputes on the relative merits of gas and electricity, carried on before the prospect, have frequently resulted in the prospect turning to oil. The treatment of this problem calls for joint committee or staff decision on "border-line" applications. This plan can easily be put into effect in combination gas and electric utilities. The principle holds equally well when separate companies supply gas and electricity. The battle of gas versus electricity, if there is occasion for one, should be staged within the utility organizations and not in the office of the prospect.

Impression That Gas Must Necessarily Prove Cheaper than Electric Heating—The same reasoning that causes many prospects to cling to oil in preference to gas or electricity causes others to prefer gas to electricity—namely, the belief that lower B.t.u. cost at the burner means lower cost of finished product. In addition to the fact that electric heating in many applications does show a lower cost for energy than does gas heating, the real answer to this problem is the fact that the cost and value of the finished product, based on production secured, quality of product and operating expense, are the determining factors, and these factors are influenced by conditions surrounding the use of either gas or electricity, rather than by the relative cost of heat units.

Difficulties in Determining Customer's Actual Needs—In many cases the customer's actual requirements can be accurately determined only after actual installation of the electric heating equipment. This condition exists because of the fact that the adoption of electric heating carries with it possibilities in improved material-handling methods, lessened labor requirements and increased production schedules—possibilities that cannot be determined completely in advance on the basis of pounds of material to be handled, temperatures maintained and energy required.

Because of the inability of the apparatus salesmen to give sufficient time to any single project to work out all the related problems as well as the specific heating requirements, the manufacturers must depend largely upon the prospect's engineers to solve many of these related problems and to put up to the manufacturer the solution of specific problems only. Here is a situation into which a competent heating specialist of the utility can enter with profit to all concerned. The utility sales engineer is able to keep in more frequent contact with the prospect and should, if he can inspire the confidence of the prospect, be able to help materially in the solution of problems incidental to electric heating but having an important bearing on over-all results. The really big applications of industrial electric heat will not be achieved without the concerted efforts of the best sales and engineering talent that can be offered by the manufacturer and central station, and these must in turn enlist the co-operation of the production engineering talent of the user.

Not a Secret Process

Lack of Specific Experience Data—Manufacturers and central-station engineers agree that perhaps the most serious obstacle to wide adoption of electric heating is the lack of sufficient specific experience data. There are two reasons given for this condition: (1) Lack of performance records kept by users; (2) refusal of user to release pertinent data that give a true picture of results.

One explanation of the first situation is the low cost of electric furnace operation compared with the total cost of production. In many cases the user has no meters or records on subdivided operations and can measure the value of electric heating only as reflected in total over-all costs. There is a field for effort on the part of equipment and central-station salesmen to get the user of electric heat to install a system of records that will check the performance of the equipment. Similar records should be kept of competitive fuel-fired operations.

Refusal of the user to release pertinent data on the relative performance of electric and fuel-fired equipment is generally the result of successful results with the electric equipment and the fear that the release of his data will enable his competitor to take advantage of his progressiveness.

The strongest argument against this attitude is a recounting of the change of attitude of steel company executives and production managers. In few industries is the struggle for slightly lower costs or increased production more severe than in the man-

ufacture of steel. Years ago steel men refused to release any information relative to improved methods or equipment, each one telling himself and others that he had the best. Gradually an exchange of experience began to take place, with the result that every manufacturer learned from every other manufacturer, methods and equipment were improved, the quality of the product increased, the cost of production decreased and steel as a competitor of other materials became more strongly intrenched than ever.

Success in industry today is dependent not so much upon secret processes or equipment as upon intelligent application of the tools of production. The electric furnace is but a tool of production. Intelligent application of this tool is of greater importance than the specific furnace design.

Central-Station Radio Sales

A STOCK turnover of two and one-half times in two and one-half months and a larger net profit than that realized on average lines of merchandise has been the experience of the Kansas City Power & Light Company merchandising department since it began the sale of radio equipment some months ago. Careful buying and small stocks of recognized lines, combined with home service and demonstration, are, in the opinion of C. F. Farley, vice-president in charge of merchandising, features of first importance for a central-station radio sales program. Mr. Farley carries sufficient stock to last only 30 days, and this stock includes only four makes of equipment.

A separate department in charge of an experienced man and four salesmen has within 90 days developed a radio sales of $5,000 a month with an average stock of $5,000. More than 95 per cent of sales result from demonstration and more than 90 per cent of demonstrations result in sales. In Mr. Farley's opinion the combined advantages of increased lighting revenue and merchandise profits from the sale of radio equipment are worthy of consideration by any central station. Proper servicing of equipment is absolutely essential and every salesman in this department is able to service as well as demonstrate radio equipment. In addition to this, the department maintains a service truck and service man available to any customer up to midnight. This provision not only has helped make sales but has uncovered many prospects among visitors at customer's homes where service calls were being made.

Complete Electric Kitchen in Salt Lake Hospital

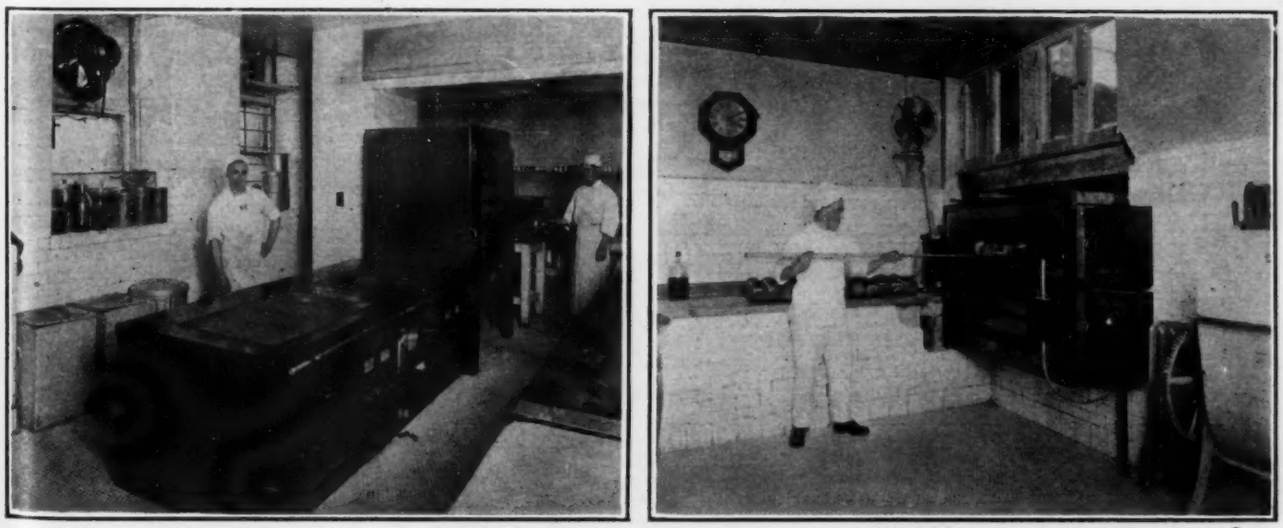
AN INTERESTING example of the efficiency of electric cooking in a hospital is afforded by the complete electric kitchen recently installed at the Latter Day Saints' Hospital in Salt Lake City by the Utah Power & Light Company. The new installation consists of a multiple-deck baking and roasting oven, two ranges, one two-deck 120-loaf oven (sectional type) and one toaster. With this new equipment the hospital, which is one of the largest in the West, is said to be the peer of any similar institution in the United States, and is one of the five hospitals so equipped in the West.

The two-deck oven has a capacity of 1,500 loaves of bread every eight hours, or 72 pies at a baking. The roasting oven will roast 300 lb. of meat at one time. The two ranges, of the hotel type, each have four burners 8x20 in., and the toaster is capable of toasting 400 slices per hour.

In addition to the new equipment, electric machinery already on the premises included two ice cream freezers, hot plates on all floors of the hospital, dish washer, meat choppers, potato peeler, refrigeration and other smaller appliances.

The institution now has a connected load of 67 kw., with a demand of approximately 43 kw. The equipment now installed provides a capacity of 1,800 to 2,000 meals per day. At the present time about 1,300 meals per day are being served.

The management of the hospital is extremely well pleased with the results obtained from the new equipment. The chef points out that, because of the flexibility possible with electric cooking, the possibility of using stored heat and other features, electric cooking has proved superior to all other methods, giving speed, capacity and economy, which are prime factors in the operation of a large kitchen. He declares the quality of the meats cooked electrically far surpasses anything in his long experience, from the standpoint of lack of shrinkage, retention of savory juices and uniformity of cooking.



ELECTRIC BAKING AND ROASTING OVENS, TOASTERS AND HOTEL TYPE RANGES IN THE KITCHEN OF THE LATTER DAY SAINTS' HOSPITAL, SALT LAKE CITY

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Hydraulic-Turbine Governing—General Principles.—S. LOGAN KERR.—To maintain the speed of its turbine substantially constant and to bring it back promptly to normal when variations do occur, the governor must control a mass of water that may run into millions of pounds, moving at a rate of 10 ft. or 12 ft. per second, without imposing undue stresses on the penstock. To meet the various requirements it must be designed to have three principal characteristics — sensitiveness, stability and correct primary and secondary compensation. The significance of these characteristics and the successive stages in the act of governing for a change of conditions are explained qualitatively, with charts showing successive changes in speed, output and gate position.—*Power*, Dec. 22, 1925.

Development of High-Head Hydraulic Turbines. — WILLIAM M. WHITE. — In this article the author points out changes that have been made during the past twenty years, mainly in details of construction and methods of speed control. Comparison between a recently constructed unit and a 13,500-hp., 350-ft.-head, 375-r.p.m. machine installed in 1906 shows no radical changes in design. Items specifically discussed and illustrated are: Details of governing, with provisions for avoiding penstock shock; draft-tube construction, the substitution of steel runners for cast iron and the provisions for easy replacement of parts, the sealing of casings and arrangements for lubrication, and the construction and operation of valves at the turbine inlet. Under the last-named heading, the growing popularity of the butterfly valve during the past eight or ten years is noted, and the belief is expressed that its successful use on heads up to 850 ft. is nearly an upper limit.—*Power Plant Engineering*, Dec. 15, 1925.

Generation, Control, Switching and Protection

Protective Equipment for Central-Station Systems.—O. J. BLISS.—The paper is devoted to a discussion of selective relays, from the operator's point of view. It deals with (1) over-current relays, induction type, inverse time with definite minimum time; (2) power-directional relays, induction type, inverse time with definite minimum time; (3) pilot-wire relay systems, balanced voltage; (4) pilot-wire relay systems, balanced current, and (5) split-conductor cable. — *Electric Journal*, December, 1925.

Oil Switch Control.—H. MATHIEU.—The author gives a detailed and illustrated description of two recent types of remote oil-switch control. The first model is of the solenoid type, requiring 1,100 watts to 4,400 watts direct current in the closing coil. The second model is motor-operated, consuming but 800 watts closing energy. Both mechanisms have the usual clutch between hand wheel and breaker and auxiliary signal contacts. Usually small size and very sturdy construction are the chief claims for these two new designs.—*Revue Générale de l'Electricité*, Nov. 7, 1925.

Transmission, Substations and Distribution

Metal-Tank Mercury-Arc Rectifiers.—F. D. NEWBURY.—In an editorial the reasons for the greater development of this device in Europe, as compared with the United States, are discussed. The metal-tank converter was an American invention, but work on it was dropped during the war, as a non-essential. In Europe a number of reasons made its commercial development easier and more necessary. Thus far it has been developed for relatively small powers. Single tanks of 2,000-amp. rating are still considered large, though this, at 600 volts, is only 1,200 kw. In this country one is interested in larger units. For railway purposes the synchronous converter has been widely applied; for lighting our practice runs to lower voltages than the European, which again militates against the mercury-arc rectifier. American engineers have considered that the principal field would be found in 1,200-volt to 1,500-volt railways. The main loss is the drop in the arc, which is 20 volts to 25 volts and is almost independent of the load At ordinary ratings at 250 volts the efficiency at rated output is 87 per cent, and at 1,500 volts it is 95 per cent. At the higher voltage the space requirements favor the rectifier as against the rotary converter, but this does not hold at the lower voltage.—*Electric Journal*, December, 1925.

Power-Factor Regulator. — J. KRISTEN.—An automatic device is described which consists of a Thury relay controlling a motor-driven induction regulator. If this device is connected into the tie line between two power stations, it will automatically maintain the power factor of the incoming energy equal to the local power factor. This will permit a perfect parallel operation between the two stations, regardless of voltage, current or direction of load exchange. The author points to the importance of this apparatus for the tying of two or more central stations into one system, as is done frequently today. Without this device the incoming energy cannot be utilized unless a certain amount of inductive or capacitive power is added to it from the local station, in order to change its phase displacement in accordance with that of the aided plant.—*Bulletin Oerlikon*, Nos. 10 and 11, 1925.

Movable Cross-Arms.—E. ILTGEN.—High-tension lines in Northern climates suffer frequently during the winter season as a result of heavy loads on the wires due to sleet and snow. Excessive sag in such cases causes phase short circuits or breakage, particularly when strong winds occur at the same time. Such troubles can be greatly lessened when the towers have movable cross-arms. A construction of this nature suitable for a double three-phase line with all six conductors in one horizontal plane has recently been developed, and this article gives a detailed account of the mechanical behavior of lines suspended on this type of towers. A number of curves show clearly how such hinged cross-arms alleviate the unequal stresses on the towers resulting from additional loads on the wires in one span and normal loads in the next span. The inertia represented by the weight of the wires and the weight of the cross-arms prevent, on the other hand, swaying of the cross-arms by merely temporary overloads, such as may be caused by gusts of wind.—*A. E. G. Progress*, November, 1925.

Units, Measurements and Instruments

Methods of Testing Transformer Oils. — HANS G. STAEGER. — This article deals with the chemical behavior of transformer oils only. A brief outline of their construction is followed by an outline of the type of reactions occurring under the influence of elevated temperatures in the presence of oxygen. Several standard tests are then critically reviewed, and the conclusion is reached that no one method can be safely employed to indicate the quality and probable life of an insulating oil. The "BBC" test is then described. It consists in heating the samples in a copper beaker exposed to air at 112 deg. C. for 300 hours and determining the resulting sludge gravimetrically, the oil-soluble acids by titration, and the probable formation of superoxides by the decrease in the tensile strength of a cotton yarn. The claim is made for this test that it is most nearly representative of service conditions and takes into account all phases of oil deterioration. — *Industrial and Engineering Chemistry*, December, 1925.

Calibration Curves for Sphere Spark Gaps.—W. REICHE.—Plotting the average values of observations of a number of investigators on flashovers between sphere gaps on a double logarithmic coordinate system, the author obtained practically straight-line curves for various ratios of gap distance to sphere diameter. Two curve sheets are given —for insulated spheres and for one sphere grounded, both for sphere diameters of up to 2 m. and voltages up to 2,000 kv. In addition, a tabulation is appended to the article to show the most appropriate sphere diameter for a given gap distance.—*Elektrotechnische Zeitschrift*, Oct. 29, 1925.

Illumination

Studies in the Projection of Light.—Part XVIII—The Sectional Paraboloidal Mirror.—FRANK BENFORD.—Previous portions of this series have dealt with projection by means of surfaces of revolution, the beams all having one feature in common—they come from a single real or virtual image. When the mirror consists of an assembly of flat sections, however, the beam radiates from a multitude of images, and

the whole is therefore composed of a multitude of individual beams that at a sufficient distance merge into one. This condition gives softness of outline, uniformity of intensity, relative freedom from images of the source and, ordinarily, high projection efficiency. These advantages are attained at the expense of beam strength, but for short-range projection the floodlight built on the sectional plan stands without a superior. In the present paper an analysis is given of this type of mirror, with formulas and tables for different conditions of design.—*General Electric Review*, December, 1925.

Motors and Control

Universal-Type Motors. — L. C. PACKER.—The term is used for small motors the performance of which is almost identical whether operated upon alternating or direct current. All of those on the market are series-wound, some having a single concentrated-pole, non-compensating field winding, others being of the distributed-field, compensated type; in general, the first-named construction applies to the smaller sizes, with ratings up to, roughly, ¼ hp. Vacuum cleaners and portable drills are two examples of very satisfactory applications for universal motors, the usual operating speeds running from 3,500 to 8,000 or 10,000 r.p.m. The characteristics are those of the series motor, except that the no-load speed is not likely to be injuriously high, as in the larger machines. Up to rated load the performance curves on direct current and on 25 cycles and 60 cycles alternating current lie quite close together, except that the higher reactance voltage of the non-compensated type causes the speed at the larger loads to fall off more at 60 cycles than at lower frequencies or on direct current.—*Journal A. I. E. E.*, December, 1925.

Selection of Electric Drives for Reversing Mills.—L. A. UMANSKY.—In a very clear and elementary way, and with a liberal use of numerical illustrations to show the practical application of his reasoning, the author takes up in detail the various considerations that govern the selection of a reversing-mill drive. The type of drive in question consists of a shunt or compound direct-current motor driving the mill, the motor in turn getting its supply from a flywheel motor-generator set, and reversal of rotation being accomplished by reversing the separately excited field of the direct-current generator. Among the data there is a table giving times, speeds, reduction in cross-section and other items in the rolling of 20-in. x 24-in., 9,000-lb. ingots to 8-in. x 8-in. blooms in thirteen passes, and an oscillogram showing the actual speed of reversal of a 30-in. reversing mill driven by a 4,000-hp. motor. The motor reverses from 80 r.p.m., its basic speed, to 80 r.p.m. in two and one-fifth seconds.—*Iron and Steel Engineer*, December, 1925.

Heat Applications and Material Handling

Some Applications of Electric Heat in Chemical Industries—ROBERT M. KEENEY.—In this final article of a series most of the important applications of this method of heating are described. The electric heating load of the baking industry is now estimated at 21,827 kw., of which 22.8 per cent is in Maine, where unusually low power rates exist. For the firing of vitreous enamel on sheet steel the electric method has several advantages, and with a power rate of 1 cent per kilowatt-hour the operating costs are probably as low as with oil at 6 cents a gallon. In chemical plants where fats or oils which congeal readily flow through pipes space heaters permanently clamped to the pipes save much time when starting up in the morning. In cooperage plants barrels are dried in one and a half to two minutes by groups of heaters let down into them. Data on such heaters are given in Table I.

TABLE I—ELECTRIC HEATERS IN COOPERAGE PLANTS

Barrel Length, In.	Diam. of Circle on Which Heaters Are Mounted	No. of Heaters	Capacity of Heaters, Watts	Length of Heaters, In.	Installed Capacity, Kw.
12	6	8	220	12	1.76
24	10	8	500	24	4.00
30	17	20	500	24	10.00

TABLE II—ESTIMATED ELECTRIC HEATING LOAD OF THE UNITED STATES

	Installed Kilowatts	Annual Kw.-Hr. Consumption	Total Power Cost	Load Factor, Per Cent	Power Cost per Kw.-Hr., Cents
Industrial Heating					
Ovens	61,639	118,272,503	$1,997,002	21.9	1.60
Unit heating	27,127	48,077,188	1,211,205	20.2	2.51
Furnaces	22,676	58,596,502	989,091	29.5	1.68
Baking	21,827	21,780,172	522,592	11.3	2.39
Summary	133,268	246,726,365	4,719,890	21.2	1.91
Melting					
Steel	142,675	317,316,430	3,864,735	25.3	1.21
Brass	29,047	88,525,354	1,415,516	34.7	1.59
Summary	171,722	405,841,784	5,280,251	26.9	1.30

Other applications on which information is given include paper drying, with a consumption in one case of 0.84 kw.-hr. per pound of paper dried, and various uses in the rubber, leather and sugar industries. Finally, an estimate is given of the magnitude of the electric heating load in the United States, as in Table II, which shows various classes of electric heat applications and their major characteristics.—*Chemical and Metallurgical Engineering*, December, 1925.

Telegraphy, Telephony, Radio and Signals

Radio Receiving-Tube Characteristics.—H. M. FREEMAN.—In this paper the several well-known static characteristics of electron tubes are first reviewed and the terms used to designate some of the interrelations are defined. So long as the power handled is very small and the input impedance is practically infinite, the static characteristics show closely the performance of the tube. In the power amplifier, however, which operates the loud speaker, the impedance drop in the tube must be taken into account, for which purpose the dynamic characteristic is needed. The manner of deriving the dynamic characteristic from the static is explained, and the desirable features of a power amplifier are pointed out. The paper includes a table giving nine constants for each of four kinds of tubes commonly used in receiving sets.—*Electric Journal*, December, 1925.

Power Dispatching by Radio.—D. R. PATTISON.—A carrier-current telephone system is used for load dispatching on the system of the Penn Public Service Corporation, operated over the high-tension lines. Some of the details are described in the article. The use of two frequencies allows conversation to pass in both directions at the same time. A selector, actuated by impulses of the carrier current, rings a bell at the called station. At one of the substations the former antenna coupling has been replaced by a condenser coupling, which is said to be three to four times as efficient, and in addition serves to drain off high-frequency surges up to 3,000 amp.—*Electric Traction*, November, 1925.

Miscellaneous

Electrical Relay System.—One of the electric signs in London includes a large thermometer consisting of an illuminated white trough in front of which a shutter of opaque material is made to rise or fall. The upper limit of the visible surface then indicates the air temperature. The present article describes the relay mechanism and gives diagrams of the circuits.—*Electrician (England)*, Oct. 23, 1925.

Automatic Coffee Percolator.—W. KRASKA.—During an exhibition last fall in Leipzig an electric coffee percolator of unique design was shown. At the two ends of a lever are suspended on one side a small electrically heated metallic boiler, at the other end a heat-resisting glass vessel holding a proper amount of ground coffee. As soon as the water in the metallic vessel boils the steam is carried through the hollow lever into the glass container, where it condenses and makes the coffee. After a certain amount of water has thus been evaporated from the boiler the equilibrium between the two vessels has been sufficiently disturbed to make the coffee vessel pull the lever down. This will disconnect the heating unit, causing the boiler to cool down. The vacuum created thereby sucks the coffee back into the metal vessel, whence it may be drawn off through a spigot.—*Elektrotechnische Zeitschrift*, Dec. 10, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Demand Attachment, Governor for Small

A small flywheel, driven from the escapement shaft, has been added to the demand attachment of our meters. This governor takes up the former very quick throw of the escapement mechanism at the time of resetting, thus eliminating entirely any tendency to jar the hand through the action of the reset mechanism.—*Sangamo Electric Company, Springfield, Ill.*

Glass, Protective, Against Ultra-Violet Rays

A blue glass recently made at the bureau has, in addition to the color and other desirable properties of the ordinary blue glass, the valuable property of furnishing protection against the ultra-violet rays. The glass can be made by replacing about half the lime in a soft soda-lime glass with cerium oxide and adding sufficient cobalt oxide to produce the desired color.—*Bureau of Standards, Washington, D. C.*

Instrument Transformers, Precision Multi-Range

Test equipments have been designed and built for determining the ratio and phase-angle errors of commercial current and potential transformers. The equipment is not only self-contained and self-calibrating, but also furnishes means for loading. A comparatively inexperienced tester, after a short instruction, can test instrument transformers with a minimum of time and great precision.—*O. A. Knopp, Pacific Gas & Electric Company, San Francisco.*

Steel, Transparent

Dr. Karl Mueller of the Physical Technical Institute of Berlin has succeeded in producing sheets of steel so thin that they are as transparent as the clearest glass. Alpha rays, which are completely blocked by a sheet of paper, are not perceptibly weakened in passing through such a metal sheet. These sheets are not more than thirty layers of atoms in thickness. Dr. Mueller makes them by depositing a film of metal electrolytically and afterward separating it from the foundation.—*Science Service, Washington, D. C.*

Temperature Recorder for Revolving Field Coils

The circuit used is a Kelvin double bridge, so that while the main field current is used for making the measurements, these measurements are independent of the value of the field current. The brush and contact resistance are not included with the resistance of the field coil itself. Two auxiliary brushes are provided on the main slip rings, and these are required to carry only a very minute current. These two auxiliary brushes are in series with two of the ratio arms in the bridge, of about 10,000 ohms, so that the contact resistance at the auxiliary brushes is negligible. This recorder is equipped with two alarm contacts—a high and a low.—*Leeds & Northrup Company, Philadelphia.*

Watt-Hour Meters, Reduction of Temperature Errors in

To reduce the error due to the permanent magnet, a small shunt controlled by a thermostatic arrangement is used. To reduce the errors due to changes in the phase relations in the voltage circuit, the inductive load-adjustment plate is controlled by thermostatic strips which change its position with the temperature.—*Duncan Electric Manufacturing Company, Lafayette, Ind.*

Wavemeter, Electromagnetic

A high degree of accuracy and sensitivity is obtained by using a combination of a two-element vacuum tube and direct-current galvanometer which measures the voltage across the condenser in the resonant circuit, instead of the current in the inductance, as is the common practice. By means of Lecher's wires the device can be calibrated for wave lengths between 3 m. and 100 m.—*W. W. Salisbury, University of Iowa, Iowa City.*

Welding, High-Strength Rod for

A new welding rod has been developed consisting of steel containing much more manganese and silicon than the usual mild-steel rod. These admixtures form a slag which prevents oxidation of carbon and thus gives a seam with a much higher percentage of carbon and greater tensile and bending strength. For details see *American Welding Society Journal*, 1925, Vol. 4, page 23.—*J. R. Dawson Union Carbide & Carbon Research Laboratories, Long Island City, N. Y.*

In Progress or Purposed

Condenser, Series Resistance of, at Radio Frequencies

The variable condenser is placed in a radio-frequency (10^6 cycles) circuit with a coil made of fine wire with approximately the same high-frequency and direct-current resistance. The resistance of the circuit is measured by the well-known resistance variation method. The resistance is then measured with a second coil exactly like the first, replacing it, and again with the two coils placed in series opposition so as to have the same inductance as that of one coil. From these three readings the resistance of the coils and the resistance of the condenser can be determined.—*Charles D. Callis, Indiana University, Bloomington, Ind.*

Conductors, Large-Diameter, Tests on

Prof. A. E. Knowlton of the Sheffield Scientific School, Yale University, will conduct in his laboratories a series of tests on the electrical and mechanical characteristics of large-diameter conductors, such as hollow-core copper, steel-core aluminum and steel-core copper, in the non-corona forming size.—*Overhead Systems Committee of the N. E. L. A.*

Ingots, Steel, Heating of, by Electricity

The results of our experiments so far have demonstrated that ingots can be heated electrically and in a manner which will insure almost ideal performance when going through the rolls in the mills. If proper heating of ingots will help in the minimizing of "tears," aggravated in rolling, then there can be no question about the efficiency of this method. This, taken with the decrease in power to roll, the decreased loss in scale and the reduced wear and tear upon the mills, are factors of great importance and have a very direct bearing on the final cost of the products rolled.—*H. A. Butler, Donner Steel Company, Inc., Buffalo, N. Y.*

Insulation, Liquid

The outstanding problem is the study of the life or durability of transformer oil. In a further comprehensive series of tests fourteen samples of various kinds of transformer oil have been prepared by a subcommittee. Twelve laboratories, ten in this country, one in England and one in Sweden, have agreed to make one or more of the following tests that are in use for determination of the durability of transformer oil, namely, the Michie, German Nine, French, Brown-Boveri Company and Norline sludging tests and the General Electric accelerated life test, described in the society's *Proceedings* for 1923 and 1924.—*American Society for Testing Materials, Philadelphia.*

Metals, Effect of Temperature on

Our research program includes the following: (1) Accumulation of existing unpublished data covering satisfactory and unsatisfactory service in different fields of engineering, of various materials under high temperatures; (2) the making of studies leading to standardization of the procedure for testing materials at high and low temperatures; (3) outlining and fostering new research in this field. The standing committees of the society are invited to make suggestions on the work contemplated. A complete bibliography on the testing and use of materials at high and low temperatures is being prepared. A number of laboratories will be invited to co-operate in conducting tests.—*American Society for Testing Materials.* [This work is of interest to the electrical industry because of increasing steam pressures and temperatures, and perhaps in electric refrigeration.—EDITOR.]

Piezo-Electric Resonator, Electric Network Equivalent of

Starting with the fundamental differential equations given by Cady (*Proceedings I.R.E.*, Vol. 10, 83, 1922) for the current to a piezo-electric resonator and for the forced vibrations of the resonator under an applied alternating potential, it has been shown that the crystal itself may be replaced by a series combination of certain inductance, capacity and resistance. In parallel with this series combination is a capacity which, when the electrodes are close to the crystal and of the same area, can be expressed by a difference of two terms, the first term being associated with the ordinary dielectric displacement and the second with the static piezo-electric displacement. The problem of a vacuum-tube circuit containing the crystal is now being investigated by this method.—*K. S. Van Dyke, Wesleyan University, Middletown, Conn.*

Varnishes, Insulating

The sub-committee on the subject has reported some interesting experiments looking toward the use of aluminum instead of copper in preparing dielectric-strength test specimens. It is proposed to modify the requirements for viscosity test of varnishes in the present tentative methods by specifying that the results shall be reported in absolute viscosity units (centipoises)—*American Society for Testing Materials, Philadelphia.*

Suggestions for Research

Lamps, Gaseous-Conduction Type (Moore)

At the September, 1925, annual convention of the Illuminating Engineering Society D. McFarlan Moore presented a paper describing a gaseous-conduction lamp with pure magnesium electrodes in an atmosphere of neon. This lamp is not only an extremely interesting object for study and further improvement, but also offers a number of important practical and scientific applications. Some of these are mentioned in the companion paper by L. C. Porter.

Meter-Service Switches

The meter committee of the N. E. L. A. has made a broad survey, by means of questionnaires, of the practices in use by member companies relative to the use of meter service switches. In some localities the service fuses are sealed in the box, while in others the service fuses are made accessible in conjunction with proper safety devices. Some companies require the switch and the fuses to be connected ahead of the meter with the fuses dead when the switch is open, while others do not have this requirement. Various other features have similarly opposite treatment, depending upon the local viewpoint, and a unification of practices seems desirable.

Oscillator, Tungsten-Argon Rectifier as

A mercury-arc rectifier may be inverted to produce oscillations using a source of direct current (Vreeland oscillator). It has been found that a tungsten-argon rectifier (tungar or rectigon) is also capable of acting as a generator of oscillations, and it is desired to develop it into a practical form. Much preliminary work, done by Yasusi Watanabe, will be found in the *Journal of the Institute of Electrical Engineers of Japan* for 1922 and 1923; see *Science Abstracts* for exact references.

News of the Industry

Conowingo Is Approved

Pennsylvania Commission Grants Petition of Philadelphia Electric for Susquehanna Project

CONOWINGO is back in the scheme of material things. On Tuesday evening of this week the Pennsylvania Public Service Commission approved the petition of the Philadelphia Electric Company, the financial conditions imposed last month by the commission having been fulfilled and the Philadelphia Rapid Transit Company having formally withdrawn the objections which had for so many months operated to delay sanction of the great Susquehanna River project. The conditions, as already explained, placed the rate of return for the project upon the basis of 7 per cent of investment cost, eliminated the so-called coal clause, eliminated the issuance of bonus stock and made other provisions. The commission estimates that these changes will save the payers of rates $1,000,000 a year.

The Maryland Public Service Commission, which was awaiting action by Pennsylvania, followed suit by approving the project on Wednesday, and the Federal Power Commission, which was in turn waiting on the two states, is virtually certain to add its indorsement when next it meets. Stone & Webster, who hold the contract for building the plant, will, it is understood, give a very large sub-contract for construction of the dam to the Arundel Corporation of Baltimore. This sub-contract is thought to involve $20,000,000 or more. The entire project is to cost $52,000,000.

The Pennsylvania commission also issued an order for extension of rural electrification lines in Pennsylvania by prescribing rules under which the utilities will be obliged to extend their lines in rural communities in which there are three or more prospective consumers to each mile of territory.

Major-General Taylor Favors Power from Susquehanna

Doubt is cast by Major-General Harry Taylor, chief of engineers, U. S. A., upon the desirability of the government undertaking large expenditures to improve navigation on the Susquehanna River, and the conclusions of the district engineer that power development on this river should be encouraged instead are indorsed by his chief.

"The district engineer," says General Taylor, "presents a careful and valuable general study of the technical and financial aspects of power production under the scheme outlined by him. His conclusion is that, based on a charge of $100,000,000 against the power feature, it would be practicable to undertake the development and market the power on a financially successful basis. With the navigation feature eliminated, he is of the opinion that the cost of the power development would be less that the $100,000,000 estimated."

Expansion in New Jersey

Public Service Electric & Gas Company Accomplishments in 1925 and Program for 1926

COMPLETION this year of the first section of the Kearny (N. J.) generating plant, which is to be operated by the Public Service Electric & Gas Company and has been under construction since July, 1923, will add greatly to the capacity of the Public Service system. The new station will represent ultimately a capital investment of about $25,000,000. The equipment to be installed in the new Kearny station includes five turbo-generators. Three of these, each of 39,200 kva. capacity, will be the product of the General Electric Company, while the other two, of 43,750 kva. each, will represent the Westinghouse Electric & Manufacturing Company. The first of these big generating units, a General Electric machine, has already gone into service, and the second unit, a Westinghouse turbo-generator, will follow soon.

The first section of the Kearny station will thus have a capacity of 205,100 kva.—more than twice the company's entire available capacity in 1914. The second section, when built, will double this rating. Eighteen steel towers carry 132,000-volt cables connecting Kearny with the Essex and Marion generating stations. Upon completion of the present project, this tie-in will make available a total capacity of 504,500 kva., and with the erection of the second section the combined capacity of the stations will be 709,600 kva., making the generating plant one of the largest in the country.

Extensive improvements and additions to existing generating stations were completed in 1925. The capacity of Essex station has been quadrupled. At the Marion plant modern machinery has replaced the original installation, its present capacity exceeding 103,500 kva., against 15,000 kva. when placed in operation in 1906. The Burlington station, the principal source of electric power in the Public Service southern district, has been improved and enlarged until its present capacity is more than six times that with which it started in 1914. The Burlington station's output is supplemented by the Camden and Trenton plants, and three large submarine cables laid on the bed of the Delaware River between Camden and Philadelphia enable the company to obtain surplus power from the Philadelphia Electric Company for use in southern New Jersey. A similar cable across Arthur Kill at Perth Amboy now connects the system with that of the Staten Island Edison Corporation of Richmond Borough, New York.

An Eight-Headed Goliath

Seven "Giant Power" Bills Before Pennsylvania Legislature and Another to Come

SEVEN bills in the interest of Governor Pinchot's scheme of "giant power" were introduced in the Pennsylvania Legislature when it met in special session on Wednesday of this week. An eighth bill, regulating interstate commerce in electric power, not yet prepared, will be introduced later. These eight measures will take the place of the series of twenty-two introduced during the regular 1925 session, which were still in committee on the day of adjournment.

A Giant Power Board is created by the first bill with the same powers to investigate given the Giant Survey Board in 1923. Wide regulatory and directory powers regarding the development of the state's power resources are also given this board by other bills.

The second bill amends the corporation act to permit the creation of giant power companies, public service generating companies and public service transportation companies. It also confers on giant power companies and the transmission companies the right to condemn for their own use such lands as the Giant Power Board finds necessary. The necessity must be established by the board before land can be taken by any electric company.

The board is authorized by the third bill to issue fifty-year permits to giant power companies, and without these they shall not operate. Three hundred thousand kilowatts is the minimum fixed for steam stations operating in or near coal fields. Under the permit the companies can recover by-products from the coal, sell these by-products and operate transmission lines with 110,000 volts as a minimum. The companies are permitted to sell energy to electric companies of the usual type, but these are obligated by other bills to sell that energy to consumers at reasonable prices. The organization of giant power companies is left to private initiative. The giant power plan also includes the integration of electric service in the state, creating one large power pool into which all producers will pour their output and from which all consumers will get their current.

The fourth bill provides for the interconnection of the electric systems and completes the process by imposing upon the operators of transmission lines the duty of purchasing without discrimination from all producers and delivery without discrimination to all distributing systems. A provision is contained in the bill for the districting of the state existing major transmission systems, each system to assume the duty of being a common purchaser and a common seller.

The fifth measure, would subject security issues of electric companies to

regulation. The sixth and seventh bills give farmers the privilege of building their own distributing systems, connecting at their own expense with any company's transmission line and purchasing energy at wholesale at the average cost of generation and distribution over the company's whole system. Under the one bill distribution is through incorporated electric districts and under the other through mutual electric companies.

Governor Pinchot also recommends the passage of laws to make the anthracite coal mines public utilities subject to regulation by the Pennsylvania Public Service Commission and providing for the control of retail prices of anthracite coal by agreement with other commonwealths.

Administration's Water-Power Policies

Cabinet Members Outline Government's Stand on Boulder Canyon Dam and Oppose Tennessee River Delay—Governor Peay Emphatic for Speed

BY PAUL WOOTON

Washington Correspondent of the ELECTRICAL WORLD

THE administration has outlined its Colorado River policy in a report made by the Secretary of the Interior on the Swing-Johnson bill. The report was made, it is understood, after Secretaries Work and Hoover had discussed the matter at length with the President. It recommends the construction with federal funds of a dam in the Colorado River to be 550 ft. high, which will create a reservoir of 26,000,000 acre-ft. capacity. The all-American canal, connecting the Colorado River with the Imperial and Coachella Valleys, is held to be an essential part of the plan.

The electrical energy which will be developed in connection with the project should be sold, the report says, at the switchboard to the highest bidder. The purchasers of the power will be in the entire charge of distribution and they must provide their own transmission lines. A unified power plant, Dr. Work contends, is better than the allocation of power privileges as proposed in the Swing-Johnson bill. Joint use of trunk transmission lines, it is pointed out, is no longer an experiment.

The benefits of the development under the administration plan are to be available only to the states that ratify the Colorado River compact. "Interstate and international rights and interests involved, the diversified benefits which will flow from the construction of these works, the waiting necessities of cities for increased water supplies, the large development of latent agricultural resources, the protection of those already developed and the immense industrial benefits which will come from the production of cheap power," says the report, "appear to render desirable the construction and subsequent control of these works by the federal government. All uses can be co-ordinated and the fullest benefits realized only by centralized ownership and control."

The reservoir in Boulder Canyon, Secretary Work figures, will cost $41,500,000. To develop 1,000,000 hp. of electrical energy will cost $31,500,000, it is estimated. The cost of the all-American canal is placed at $31,000,000. The main source of revenue will come from the sale of power. Wholesale prices of power in the West now range from 3½ mills to 8 mills per kilowatt-hour, measured at the switchboard, it is declared. Assuming that only 3 mills will be realized, the revenue would amount to $10,800,000 annually, it is calculated, as 3,600,000,000 kw.-hr. would be generated. Storage and sale of water for irrigation and domestic purposes would net $1,500,000. Operation, maintenance and fixed charges would be $6,000,000 annually, Dr. Work says. Repayment of the entire federal expenditures therefore would be possible in twenty-five years. It is recommended further that the construction work be placed in the hands of the Reclamation Bureau.

Governor Protests Against Delay in Tennessee Development

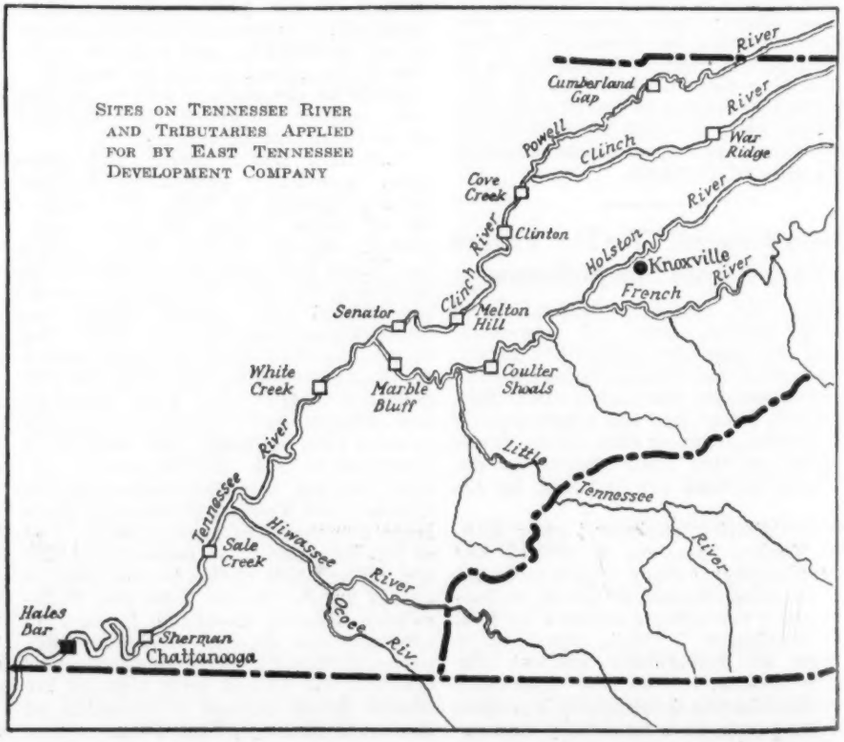
While only the opponents have appeared, as this is written, at the hearings on the Norris resolution proposing to suspend the authority of the Federal Power Commission to issue licenses on the Tennessee River, the indications are that Senator Norris will not be able to secure a favorable report. If the legislation should be reported to the Senate, it is safe to predict that it will not be passed perfunctorily as was the similar resolution of Senator Pittman dealing with the Colorado, and even were the measure to pass the Senate it would seem to have little prospect of getting through the House.

The feature of the first day's hearing was a letter written by Governor Austin Peay of Tennessee protesting against the resolution. In part the Governor said:

"The sentiment in this state is practically unanimous in opposition to any congressional interference with the earliest possible action by the Federal Power Commission on the pending applications. The inevitable delay which would result from the adoption of that resolution would irreparably affect the industrial development of this state. We consider that the manufacture and distribution of electrical energy for commercial sale is a gross perversion of federal authority. Our people are unalterably opposed to the federal government taking over for development these power sites. We need the tax revenues from the private ownership and development of those sites, and we prefer to retain our right to control the charges which the public must pay for that power.

"Our people are tired of waiting on Muscle Shoals and know that no harm can result to the Shoals plant from the contemplated present development of the upper Tennessee and its tributaries. It is well known that strong financial interests are asking those permits, and it is believed that the earliest development is intended by those interests, represented in at least one of the applications. What Tennessee wants is the earliest possible development."

The hearings are expected to continue for a considerable period. The advocates of public ownership will be heard at length, it is expected, and there will be some support for the resolution outside of the public owner-



ship group. The Union Carbide Company will present arguments in favor of the resolution, it is asserted by a representative of that company. The company has taken this position as a prospective bidder for Muscle Shoals and wants no rights granted at Cove Creek or other points until it is known that the release of water will be coordinated with requirements at Muscle Shoals.

Senator Norris promises prompt committee action on the House resolution providing for a joint congressional committee to receive bids for Muscle Shoals. If that resolution passes, he declares, he will not press his Tennessee River resolution.

Three Cabinet Members Declare Against Delay on Tennessee

In a report made to the chairman of the Senate committee on agriculture by the Secretaries of War, the Interior and Agriculture, in connection with Senator Norris' bill suspending the authority of the Federal Power Commission to issue licenses on the Tennessee River, these Cabinet members declare that any essential modification of the policy laid down in the water-power act would be a menace to the public interest and that the approval of the resolution would be prejudicial to the interests of the United States in the power project at Muscle Shoals. Commenting further, the Secretaries say:

"There have been filed with the commission since its creation in 1920 eleven applications for power projects at twenty-five separate sites on the Tennessee River and its tributaries above Muscle Shoals and three applications on the river below Muscle Shoals. Of those above Muscle Shoals the commission has granted a preliminary permit in one case. On the remaining projects no action has yet been taken. It has not acted on any of the three applications below Muscle Shoals. On account of the survey being conducted by the War Department on the Tennessee River the commission, except in the one instance, has suspended action on applications before it, awaiting the information which the survey would furnish, in order that it might be assured, if it approved any project, that such project would be adapted, as the law requires, to a comprehensive scheme of development of the river for purposes of navigation, of water power and of other beneficial public uses. In the one case in which it has acted it was convinced that the project approved would be adapted to such a comprehensive plan. In its consideration of the Tennessee River the commission has held constantly in view, not only the relation of any proposed project to a general plan of river development, but also the relation of the various projects to the government's dam and power house at Muscle Shoals."

After reviewing the existing plant conditions at Muscle Shoals and various plans proposed for increasing continuous output, especially by means of storage reservoirs above the Shoals, the Secretaries say:

"When the United States builds a power project, as it has done at Muscle Shoals, it is not, of course, liable for any assessment for benefits received from headwater improvements constructed by others. It gets such benefits gratis. Under such circumstances, coupled with the requirement placed in every license involving storage that such storage shall so be handled as to be to the common benefit of all past whose plants the waters run, it should be apparent that the government's interest in the development at Muscle Shoals will not be injured, but will in fact be promoted, by the construction of storage reservoirs by licensees under the federal water-power act. We are clearly of the opinion that suspension of action on the applications before the commission, except to the extent necessary for the commission to assure itself that the projects applied for will be in the general public interest and will be adapted to a general plan of river development, would be distinctly detrimental to the interests of the United States at Muscle Shoals."

Canada Installs 719,000 Hp. in 1925

Quebec and Ontario Make Great Gains in Hydro-Electric Development —British Columbia and Manitoba Next in Order— Other Provinces Stationary

REMARKABLE progress was made during 1925 in hydro-electric developments throughout Canada, according to a preliminary report just issued by the Water Power Branch of the Department of the Interior. The new installations total 719,000 hp. The generating capacity now aggregates 4,290,000 hp. The year's developments represent a direct investment of $70,000,000 without regard to new capital required in the application of the power. Projects already under way will make a further addition of 250,000 hp. in the early part of the present year. Quebec made the largest addition for the year, 438,300 hp., and Ontario came second with new installations of 199,750 hp. British Columbia added 58,984 hp. and Manitoba 21,900 hp.

The year marked the coming into operation of certain huge power enterprises which have been in course of construction for some years. The most important of these are the Queenston development of the Ontario Hydro-Electric Power Commission on the Niagara River, with 500,000 hp. completely installed, and the Duke-Price company's development on the Saguenay River in Quebec, with an installation of 360,000 hp. out of an ultimate capacity of 540,000 hp. One of the more important developments now in course of construction is the 800,000-hp. project recently commenced by the Aluminum Corporation of Canada at Chute-à-Caron on the Saguenay. The British Columbia Electric Railway's projected operations on the Bridge River are also of ultimate large size.

In the Maritime Provinces the only actual hydro-electric construction completed in 1925 was a 245-hp. installation at Annapolis, Nova Scotia, but a number of extensions and new plants are in prospect, the most important the provincial undertaking at Grand Falls on the St. John River which has caused so much controversy in New Brunswick.

In the eastern townships of the Province of Quebec the Southern Canada Power Company completed the installation of a 37,800-hp. plant at Hemming Falls. Other developments of importance were carried on by the Ottawa River Power Company, the Chicoutimi Electric Company, the Gatineau River Power Company, the International Paper Company and some smaller companies.

Commenting on the prospects for 1926, the report says: "While it can hardly be expected that the record installation of 1925 will be equaled in 1926, there is every reason to believe that substantial increases will continue to be made each year."

INSTALLED HORSEPOWER A YEAR AGO AND NOW

	1925	1926
British Columbia	355,722	414,706
Alberta	34,107	34,107
Saskatchewan	35	35
Manitoba	162,025	183,925
Ontario	1,585,182	1,784,932
Quebec	1,308,106	1,746,406
New Brunswick	44,656	44,656
Nova Scotia	63,957	64,202
Prince Edward Island	2,276	2,276
Yukon	13,209	13,209
Total	3,569,275	4,288,453

Export of Des Chats Power to United States Forbidden

The attitude of the Province of Quebec with respect to the export of power to the United States is clearly emphasized in the provisions applicable to the lease of the Des Chats Falls on the Ottawa River, which will be offered by auction on Feb. 13. While the Province of Ontario will be allowed its share of the power to be developed at this site, threats are made of cancellation of contract if any power is exported to the United States.

The water power which may be developed after agreement with all the parties concerned is set at about 100,000 hp. The development must be within five years of the signature of the contract. Regarding the export clause the projected contract reads: "It is expressly stipulated that no power or electrical energy shall be exported outside of Canada, either directly or indirectly, and, in case of breach or infraction of this clause, the government reserves the right to cancel and annul the lease after three months' notice and to take back possession of the property leased. The Minister may, however, authorize the exportation of power to Ontario without any additional charge."

Further evidence of Quebec's determination to retain full control of its hydro power was given in a definite

statement in the speech from the throne at the opening of the Legislature on Jan. 7. While definite announcement is lacking, it is understood on good authority that the present royalty of 50 cents per horsepower developed at certain waterfalls will probably be more than doubled and that the additional royalty of 50 cents levied on horsepower exported to other provinces will be increased.

A.I.E.E. at White Sulphur

West Virginian Springs Selected for Summer Convention—Three or More Regional Meetings

WHITE SULPHUR SPRINGS, W. Va., has been selected as the place and the last week of June as the time for the summer convention of the American Institute of Electrical Engineers. Three, and perhaps five, regional meetings are also to be held by the Institute this year. The first of these will be at Cleveland on March 18 and 19, the second at Madison, Wis., on May 6 and 7, and the third at Niagara Falls on May 26-28. In the latter half of the year there may be regional meetings in New York and Kansas City.

The Cleveland meeting will be held at the Hotel Cleveland, and the principal topics discussed will be sectionalized electric drive and electric refrigeration. The papers on sectionalized drive will apply specifically to paper-making machines but will, it is felt, attract engineers interested in rubber mills, wire mills and other industries where such drive is desirable. S. A. Staege of the Westinghouse Electric & Manufacturing Company, H. W. Rogers of the General Electric Company and R. N. Norris of the Harland Engineering Company will present three papers on the subject on the first day of the meeting, while on the second day C. F. Kettering, president of the General Motors Research Corporation, will discuss electrical refrigeration and Ex-president Farley Osgood will speak on "The Human Side of Engineering." A dinner will be held on March 18, when City Manager Hopkins of Cleveland and John Stanley, president of the Cleveland Railway, are expected to speak.

Rural electrification, interconnection, co-operative research relations between colleges and industries and underground distribution developments will be features of the meeting at Madison, and measurements of dielectric loss, transmission, power plants and other topics have been selected for discussion at the three-day meeting at Niagara Falls.

Institute Asks A. E. S. C. to Set Up New Electric Committee

At the last meeting of the board of directors of the American Institute of Electrical Engineers a resolution was passed recommending to the American Engineering Standards Committee that it set up an electrical advisory committee composed of representatives of (at least) the chief interested groups to advise the main committee on all questions related to electrical standards and to serve as a general coordinating committee in the electrical field, and, further, that the advisory committee so set up should be so constituted as to permit the appointment of special committees of experts to pass upon specific questions where this is desired and desirable.

The board of directors adopted standards No. 9 (on induction motors and machines) and No. 30 (on wires and cables) as Institute standards, with reference to the proper committees for consideration and report to the sponsor, after which No. 9 will be referred to the A.E.S.C. for approval as an American standard. Sections Nos. 5, 7 and 10 were referred to the sectional committee on rating of electrical machinery.

Midwinter Institute Program in Readiness

Plans for the midwinter New York convention of the American Institute of Electrical Engineers, which will be held in the Engineering Societies Building on Feb. 8 to Feb. 11 inclusive, are about complete. The wide range of subjects includes transmission stability, protective and control systems, bus and structural construction, electrical machinery, measurements, insulation and dielectric absorption, electromagnetism and electrophysics, communication and sound reproduction, and furnace-resistor design. On Wednesday, Feb. 10, there will be a dinner-dance at the Hotel Astor, and on Thursday evening an address by a prominent speaker not yet selected. The program is printed below.

Program of Midwinter Convention of the A.I.E.E.

NEW YORK, FEB. 8-11

Monday, Feb. 8

Afternoon. — Transmission Session: "An Investigation of Transmission-System Power Limits," C. A. Nickle, General Electric Company, and F. L. Lawton, Quebec Development Company; "Calculation of Steady-State Stability in Transmission Lines," Edith Clarke, General Electric Company; "Practical Aspects of System Stability," Roy Wilkins, Pacific Gas & Electric Company; "Further Studies of Transmission Stability," R. D. Evans and C. F. Wagner, Westinghouse Electric & Manufacturing Company; "Transmission Systems with Overcompounded Voltages," H. B. Dwight, Massachusetts Institute of Technology.

Evening. — Dielectrics and Insulation: "Dielectric Absorption and Theories of Dielectric Behavior," J. B. Whitehead, Johns Hopkins University; "Theory of Absorption in Solid Dielectrics," V. Karapetoff, Cornell University; "Ionization Studies in Paper-Insulated Cables," C. L. Dawes and P. L. Hoover, Harvard University.

Tuesday, Feb. 9

Morning.—Protection, Control and Bus Construction: "Operating Performance of a Petersen Earth Coil—II," J. M. Oliver and W. W. Eberhardt, Alabama Power Company; "Theory of the Auto-Valve Lightning Arrester," Joseph Slepian, Westinghouse Electric & Manufacturing Company; "Current-Limiting Reactors with Fireproof Insulation on the Conductor," F. H. Kierstead, General Electric Company; "Temperature Rise and Losses in Structural-Steel Members Exposed to the Fields from Alternating-Current Conductors," O. R. Schurig and H. P. Keuhni, General Electric Company; "Carrying Capacity of 60-Cycle Buses for Heavy Currents," Titus G. LeClair, Commonwealth Edison Company; "Supervisory Systems for Electric Power Apparatus, Chester Lichtenberg, General Electric Company.

Afternoon.—Parallel Sessions, A and B. (A) Electrical Machinery: "Experimental Determination of Losses in Alternators," Edouard Roth, Société Alsacienne de Constructions Mécaniques; "No-Load Copper Eddy-Current Losses," Thomas Spooner, Westinghouse Electric & Manufacturing Company; "Mechanical Force Between Electric Circuits," R. E. Doherty and R. H. Park, General Electric Company; "Concluding Study of Ventilation of Turbo-Alternators," C. J. Fechheimer and G. W. Penney, Westinghouse Electric & Manufacturing Company. (B) Communication and Sound Reproduction: "Development and Application of Loading of Telephone Circuits," William Fondiller, Western Electric Company and Thomas Shaw, American Telephone & Telegraph Company; "Automatic Enciphering and Deciphering Systems," G. S. Vernam, American Telephone & Telegraph Company; "Refraction of Short Radio Waves in the Upper Atmosphere," W. R. G. Baker and C. W. Rice, both of General Electric Company; "High-Quality Recording and Reproducing of Music and Speech," J. P. Maxfield and H. C. Harrison, Bell Telephone Laboratories, Inc.

Wednesday, Feb. 10

Morning. — Electrical Machinery: "Parameters of Heating Curves of Electrical Machinery," V. Karapetoff, Cornell University; "Rating of Electrical Machinery as Affected by Altitude," C. J. Fechheimer, Westinghouse Electric & Manufacturing Company; "Motor-Band Losses," Thomas Spooner, Westinghouse Electric & Manufacturing Company; "Starting Characteristics of Polyphase Squirrel-Cage Induction Motors and Their Control," H. M. Norman, Westinghouse Electric & Manufacturing Company.

Thursday, Feb. 11

Morning. — Electromagnetism and Physics: "Calculation of Magnetic Attraction," Th. Lehmann, consulting engineer; "The Magnetic Hysteresis Curve," Hans Lippelt, with Thomas E. Murray, Inc.; "Properties of the Single Conductor," Carl Hering, consulting electrical engineer; "Heaviside's Proof of His Expansion Theorem," M. S. Vallarta, Massachusetts Institute of Technology.

Afternoon. — Measurements, Machinery and Industrial: "A New Wave-Shape Factor and Meter," L. A. Doggett, J. W. Heim and M. W. White, all of Pennsylvania State College; "Practical Application of Vibration Instruments to Rotating Electrical Machines," J. Ormondroyd, Westinghouse Electric & Manufacturing Company; "Use of High Frequency for Testing Insulation of Rotating Apparatus," R. E. Ferris and J. L. Rylander, both of Westinghouse Electric & Manufacturing Company; "The Cross-Field Theory of Alternating-Current Machines," H. R. West, General Electric Company; "Rating of Heating Elements for Electric Furnaces," A. D. Keene and G. E. Luke, both of Westinghouse Electric & Manufacturing Company.

Purchases and Mergers

Transactions in New York, New Hampshire, Wisconsin, Indiana and Oregon

PETITION has been filed with the New York Public Service Commission by a group of companies operating in Columbia, Dutchess and Putnam Counties for authority to transfer their franchises, works and systems to the Harlem Valley Electric Corporation of Pawling, Dutchess County. The companies involved are the Carmel Light & Power Company, Chatham Electric Light, Heat & Power Company, Lebanon Valley Lighting Company of Canaan, Morgan & Wyman Electric Light & Power Company of Dover Plains, George Juengst & Sons of Croton Falls, Katonah Lighting Company and Amenia Electric Light & Power Company. The commission in 1925 denied permission for purchase of these companies by the Harlem Valley Electric Corporation because it was proposed to sell the stock of that company to the Consumers' Electric Service Corporation, organized under the laws of Delaware. It is stated in the present petition that the interests which own the capital stock of the Hudson Valley corporation also own the capital stock of the petitioners.

South Glens Falls, N. Y., has asked permission to sell its street-lighting system to the Adirondack Power & Light Corporation. No opposition has manifested itself.

The Souhegan Valley Electric Company of Milford, N. H., will, it is announced from Manchester, after Feb. 15 be added to the group of properties controlled by the New England Public Service Company, a liberal offer having been made to its stockholders. The New England Public Service Company is the Insull organization for New England, itself controlled by the Middle West Utilities Company. The Souhegan Valley Electric Company was organized Nov. 29, 1922, to acquire the property of the Milford Light & Power Company. As of Jan. 1, 1923, the plant investment was $318,014 and the assets were $358,242.

The Home Light & Power Company, a subsidiary of the Mississippi Light & Power Company, has bought the lighting and ice-making plant at Tunica, Miss., previously owned by the Planters' Oil Mill.

The Macfarland (Wis.) Light & Power Company, which has been buying and supplying electric service, has been purchased by the Wisconsin Power & Light Company. The amount involved was not made known.

The Antigo Electric Company and the Rhinelander Light & Power Company, recently purchased by the Wisconsin Valley Electric Company, are to be united under the name of the Wisconsin Valley Power Company, with main offices at Wausau.

Purchase of four electric light and power and electric railway properties in eastern Indiana by the Indiana Service Corporation, a subsidiary of the Midland Utilities Company, of which Samuel Insull is president, is proposed in a petition filed with the Public Service Commission of Indiana. These properties are the Berne Electric Light Company, the Bryant Electric Company, the Wells County Electric Company and the Marion & Bluffton Traction Company, which provides electric light and power to seven communities. The combined value of the properties, all south of Fort Wayne, is put at $1,594,197, of which the one named last represents $1,403,953. With these the Indiana Service Corporation will serve 39 communities with electric light and power.

In a three-cornered deal involving approximately $1,700,000, the two central-station companies of Portland, Ore., each acquire properties near Portland formerly operated by the Puget Sound Power & Light Company, Seattle. A unit serving territory around Hillsboro, Ore., including tied-in distribution systems serving Beaverton, Orenco, Cornelius, Dilley and Gaston, Ore., falls to the Portland Electric Power Company, which for some time has supplied power wholesale for serving this unit. The Inland Power & Light Company, owning certain properties operated by the Pacific Power & Light Company and the Northwestern Electric Company, acquires the unit serving Woodland and Kalama, Wash., and Rainier, Ore. This unit is to be operated by the Northwestern Electric Company, which is now serving territory adjacent to it in Clark County, Wash. The units of the Puget Sound company thus disposed of comprise all the properties south of Kelso, Wash., formerly attached to the southern district of the company.

Sarasota, Fla., Votes to Sell Municipal Plant

The election at Sarasota, Fla., on Tuesday to determine whether the city should sell its electric light plant for $1,000,000 to the Florida Power & Light Company resulted in a sweeping victory for the proposal. The vote stood 471 to 214. The arguments made by the citizens' committee in favor of the sale were printed last week (page 113.)

Wire Committee of N. E. L. A. Works for Harmony

A series of meetings of the executive and national committees of the N. E. L. A. Commercial Section was held this week at the Edgewater Beach Hotel, Chicago, with an unusually large attendance. The following groups were in session: Cooking and water heating, customer relations, electricity in the home, merchandising, commercial cooking and heating and industrial heating sub-committees of the power committees, refrigeration, transportation and wiring.

The wire committee held its meeting on Wednesday and considered at length the difference of opinion and policy which has arisen between this group and the Association of Electragists International over the all-metal standard of wiring advocated by the contractors, the N. E. L. A. committee having passed a resolution at its last meeting expressing dissent from the stand taken by the Association of Electragists. It was decided to write the Association of Electragists and the Associated Manufacturers of Electrical Supplies to appoint joint committees to meet with a sub-committee of the N. E. L. A. to consider the general subject of the cost of wiring and wiring standards and crystallize the common interest of the entire industry into a harmonious policy acceptable to all. A resolution was also passed to express to the N. E. L. A. representative on the electrical committee of the National Fire Protection Association a desire that the minority report of W. H. Blood suggesting rules for the use of non-metallic conduit, so long in controversy, be adopted.

Various committee sessions and conferences were still going on as the ELECTRICAL WORLD went to press.

Lower House at Olympia, Wash., Passes Jacobs Bill

The Jacobs power bill has passed the House of the Washington Legislature, now in session at Olympia, by a vote of 50 to 42, despite the fact that the bill struck a snag at the start in the committee on public utilities, where nine of the eleven members recommended that it be postponed indefinitely. The City Council of Seattle went on record against the bill, opposing it because of the taxing feature. Nine of the seventeen King County representatives, however, voted for the bill.

The bill, as already explained, permits the sale of surplus electrical energy by cities generating their own power within 50 miles of the limits of such cities. A tax of 5 per cent on the gross sales of power sold outside the city limits must be paid to the state. The author of the bill says it does not permit cities to go into the general power business, but that it brings in more taxes by providing for a 5 per cent tax on power sold outside.

Northwest Electric Inspectors Organize Enthusiastically

With enthusiasm born of an attendance far exceeding expectations and fostered by an excellent program of papers and discussion, the electrical inspectors of Oregon and Washington, with representatives of other branches of the electrical industry in the Northwest, met at Portland on Jan. 11 and 12 and perfected organization of the Northwest Association of Electrical Inspectors. L. W. Going, chief electrical inspector of Portland, was elected president, other officers being W. P. Weathers, city inspector of Longview, Wash., vice-president, and F. D. Weber, Oregon Insurance Rating Bureau, Portland, secretary and treasurer.

Some of the subjects presented and discussed were the National Electrical Code, the making of a municipal code, the Underwriters' Laboratories, electrical inspection from a fire marshal's standpoint, the causes of radio interference and the effect of grounding electrical circuits on water systems.

At the end of the two-day session the enrollment in the new association totaled 119, of whom 58 were classified as active, the others falling into the associate and industrial classes. The association will hold its convention next year in Longview, Wash.

State Power in New York

Assertion Is Made that by 1928 There May Be No Sites Left for Public Ownership or Development

STATE development of hydro-electric power, again urged in the annual message of Governor Alfred E. Smith to the New York State Legislature, has, some political observers at Albany think, almost passed out of the category of practical policies, even if the Legislature were to accept the Governor's program and pass the necessary legislation, for the reason that, if present plans mature, virtually all available water power will be under development by private interests by the end of 1927. It is asserted confidently by these commentators that the state Water Power Commission, now under Republican control, expects within a short time to close negotiations for a preliminary permit for the development by lease of 175,000 hp. in the Lower Niagara River gorge, and before the end of the year to close negotiations for development through lease of about 1,000,000 hp. in the St. Lawrence River. Completion of this program would automatically end the years of controversy over whether hydro-electric power should be developed by the state or by private interests under lease from the state.

Applications have been filed with the commission by the Louisville Power Corporation and the St. Lawrence Valley Power Corporation for preliminary permits to develop the site at the Long Sault Rapids in the St. Lawrence River, and a hearing has been set for Feb. 25. This permit, however, would not be valid without the consent of both the Federal Power Commission and the Canadian government, and while it is considered probable that the federal authorities would grant such a permit, the international aspect of the project shrouds it in doubt. In the lower Niagara gorge project the commission has already offered a preliminary permit to the Lower Niagara River Power & Water Supply Company. The time in which the company may accept has been extended to Feb. 25. As already stated in the ELECTRICAL WORLD, this project also would need the approval of the Federal Power Commission and probably that of the International Joint Commission also.

BARGE CANAL LEASES

The commission has completed negotiations for use of surplus canal waters for power purposes at six cities, and terms have been fixed for use of such water at two other sites, while certification has been made to the commission by Colonel Frederick S. Greene, Superintendent of Public Works, concerning surplus canal waters diverted at four more sites. Negotiations completed in 1925, the records show, will net the state an annual income of nearly $500,000.

The commission has adjusted the situation at Massena, where the Aluminum Company of America is operating a submerged weir on state land in the St. Lawrence in conjunction with the company's power development, by granting the company a ten-year lease to occupy the land at $11,000 a year. In addition $44,000 is charged for prior usage over a ten-year period. Leases that have been granted by the commission for surplus waters of the Barge Canal include sites at Dam No. 4 in the Oswego River, at Fulton, where a 30-year lease for the development of 2,200 hp. has been granted at $15,000 a year, instead of $5,000 as previously; at Medina, where a similar lease, at $10,000 a year, for waters developing 2,500 hp., has gone into effect, and at Dam No. 6 in the Oswego River, where a modification was authorized to facilitate use of the surplus water under a revocable permit, resulting in a saving of $10,000 a year in power operation of the state grain elevator at Oswego. The commission has also fixed the terms for other proposed leases, including one at Rochester for a 30-year period at $50,000 a year for development of 6,500 hp.

At Crescent Dam and Vischer's Ferry, in the Mohawk River, both state developments, the 16,000 hp. developed has been leased for twenty-five years for $367,000 a year. It costs the state $65,000 a year to operate the plants.

Negotiations are being conducted for surplus canal waters at three Lockport sites and one at Northumberland. One of the Lockport proposals refers to use of water involved in the international treaty with Canada and the others to waters spilled below the Lockport locks and to a lease granted a century ago.

Lofty Chicago Tower Becomes Pillar of Light

EVENING pedestrians in Chicago's "Loop" district now have their path blazoned by a brilliant illumination of the Chicago Temple tower. A system lighting the tower to the tip of the cross, 556 ft. above the pavement, transforms the structure into a giant beacon visible from every part of the city, as shown in the picture (taken between 4 and 5 p.m.), which is reproduced from the Chicago *Daily News* by special arrangement. Two hundred and three lamps, with a total rating of 74,000 watts, make up the floodlight system.

Briefer News

Radio Engineers to Hold Convention.—The Institute of Radio Engineers will hold a convention in the Engineering Societies Building, New York, on Monday and Tuesday, Jan. 18 and 19. Engineers of national prominence are on the program.

Power Plant Named in Honor of C. O. Poole.—In honor of the late Charles Oscar Poole, who was chief engineer of the Southern Sierras Power Company, Riverside, Cal., the power plant of that company which has been known as Leevining Creek No. 1 will hereafter be called the Poole plant.

Highway Illumination in Florida.—The 19-mile stretch of highway from South Jacksonville to Neptune, Fla., has been turned into a ribbon of light at night by means of General Electric "Novalux" highway lighting units. This installation, the manufacturer says, is the largest in the country. The units are equipped with 400-cp. lamps mounted high enough to eliminate glare without cutting down the volume of the illumination.

Southern Power Company Ends Curtailment of Service.—The last vestige of the power curtailments necessitated in the Southeastern States by the unprecedented drought in 1925 disappeared on Monday, January 11, when the Southern Power Company resumed full service. The existing restriction was for one day only in the week. In the period of greatest stringency service was withheld on three days of the week, the period of curtailment having been shortened several times.

Los Angeles Adds 203 Miles to Her Ornamental Street-Lighting Systems.—During 1925 there were 203 miles of ornamental street-lighting systems completed in Los Angeles. In 1924 84 miles were installed. Twenty-seven contracts which have been let call for 21 miles more, 65 contracts calling for 76 miles are under consideration, while it is estimated that approximately 500 petitions are being circulated which will call for an additional 200 miles. The total value of the systems installed in 1925 was $2,540,942.

Shreveport Plant Making Rapid Progress.—A new 40,000-kw. generating plant for the Southwestern Gas & Electric Company, which is a subsidiary of the Middle West Utilities Company, is under construction at Shreveport, La., a site having been selected on Arsenal Hill, a historic locality across the Red River from the city. Rapid progress is being made on the development. The company serves also Texarkana, Tex.-Ark., and many smaller communities.

Two Developments to Be Started in Cascade Foothills.—The state authorities of Washington have authorized the Sultan Electric Company to build two hydro-electric plants in the foothills of

the Cascade Mountains near Sultan, Wash. These plants will appropriate water from May Creek, a tributary of the Wallace River, and from other small streams with Lakes Tomtit and Roensiger as their sources. Two low concrete dams, one 100 ft. and the other 50 ft. in length, will be built, work starting very soon.

St. Joseph, Mo., to Have Lighting Sales School.—The Commercial Section of the Middle West Division, N.E.L.A., has arranged to hold a lighting sales school at St. Joseph, Mo., on Feb. 23-25 along the lines of the schools held at Nela Park, Harrison, N. J., and other places.

Hundred-Mile High-Tension Line to Connect Yazoo Delta with Jackson, Miss.—C. P. Couch, vice-president and general manager of the Mississippi Power & Light Company, Jackson, Miss., announces the intention of the company to build a high-tension line 100 miles in length from Jackson to points in the Yazoo-Mississippi delta. It will either follow the Illinois Central main line or the Yazoo and Mississippi Valley route through Yazoo City and Greenwood, and will cost about $500,000.

United Light & Power's New Davenport Headquarters.—A new office building for the United Light & Power Company and its subsidiaries has just been completed at Second and Perry Streets, Davenport, and will be entirely occupied by the company this month. The building consists of five stories and a basement, with a mezzanine floor, and is designed for the addition of three more floors. Ground dimensions of the structure are 98 ft. by 115 ft. It ranks with the best business buildings of the city and, with its furniture and equipment, has cost about $500,000.

Chippawa-Queenston Plant Carries 552,000 Hp.—An official statement has been issued by C. A. Magrath, chairman of the Ontario Hydro-Electric Power Commission, concerning the power capacity of the Chippawa-Queenston development. The figures given relate to the week of Dec. 8. "During the week," the statement reads, "when the peak demand for the year was being carried, this plant delivered over 500,000 hp. on several successive days, while on Monday, Dec. 14, a peak load of 552,000 hp. was delivered to the Niagara system." Dredging in the canal and the Welland River has hitherto prevented an authoritative estimate as to the total output capacity of the plant.

Plans of Portland Electric Power Company.—Among the items included in the 1926 budget of the Portland Electric Power Company, which, as stated last week, includes appropriations of $2,400,000 for the electric light and power department, are the installation of a 20,000-kw. steam turbine at Station L in Portland, at a cost of $560,000; $150,000 for modernizing equipment in the Oregon City hydro-electric plant, $100,000 for rebuilding part of the wooden flume at the Bull Run plant, $200,000 for modernizing and adding equipment at the Jefferson Street substation, $200,000 for building a high-tension line from Portland to St. Helens and improving existing lines, and $1,000,000 for miscellaneous additions to distribution systems.

San Diego Company to Install New Generating Equipment.—Expenditure of $1,500,000 for increased generating capacity for station B of the San Diego Consolidated Gas & Electric Company has been announced by the Byllesby Engineering & Management Corporation. The improvement will consist of a 20,000-hp. turbo-generator, additional boilers, a new intake tunnel for condenser circulating water and 6,000 kw. in additional transformer capacity. This will bring the capacity of the company's principal steam plant up to 47,000 hp. Other betterments on the system to be made during 1926 are a new substation to cost approximately $100,000, which will be known as substation F, and additions and extensions to the overhead and underground systems which will bring appropriations up to a probable total of $3,000,000.

Columbus Railway, Power & Light's Expansion Plans.—Rights-of-way for transmission lines between Columbus and Lancaster and Columbus and Chillicothe, Ohio, have been acquired by the Columbus Railway, Power & Light Company from the Scioto Valley Railway & Power Company. The contract forecasts the dismantling of the Scioto Valley power plant at Reese station. It also forecasts arrangements whereby the Columbus company will take over municipal power and light contracts at Chillicothe and Circleville now held by interests closely associated with it, and perhaps similar municipal contracts in Lancaster and other communities. These developments will be made possible by the completion in a few months of the modern Pickawby power station.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Rocky Mountain Division, N. E. L. A.—Hot Springs Hotel, Idaho Springs, Col., Jan. 25-26. O. A. Weller, Public Service Company of Colorado, Denver.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers — Midwinter meeting, New York, Feb. 8-11; regional meetings: Cleveland, March 18-19; Madison Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Suite 307, Local Bldg., Oklahoma City.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 8-10. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Substantial Rate Reductions in Spokane, Wash.—Widespread rate reductions supplying a blanket rate for all towns on the system of the Washington Water Power Company outside of Spokane and revising rates within Spokane and the Spokane Valley district were filed with the Washington and Idaho state officials on Jan. 8. A new Spokane residential rate of 5½ cents for the first 32 kw.-hr. and 3 cents for additional consumption replaced the former rate of 7 cents for the first 20 kw.-hr. and then 3 cents. The minimum of 70 cents per month remains. Reductions in commercial lighting rates are also made within Spokane. In the 52 cities and towns outside of Spokane served by the company widely varied rates are replaced by new tariffs. The new suburban residential rate in this territory is 34 kw.-hr. at 8 cents and additional consumption at 3 cents.

Rocky Mount (N. C.) Municipal Plant May Be Sold to a Power Company.—A proposal to purchase the municipal power plant now nearing completion at Rocky Mount, N. C., has been submitted to the Board of Aldermen of that place by the Virginia & Electric Power Company. A similar offer from the Tidewater Power Company of Wilmington, N. C., is expected. Both these companies have made or are making surveys with the view to expansion in northeastern North Carolina. The Virginia company's proposal is that the power company shall take over the municipal plant at Rocky Mount at what it cost the city and make it a steam auxiliary plant for its system, that the company shall furnish power from Roanoke Rapids in wholesale lots to the city, in accordance with the rates fixed by the Corporation Commission, and that the city shall distribute and retail the power, as at present.

Milwaukee-Iron Mountain Line Completed.—The long-heralded 132-kv., 250-mile steel-tower line built by the North American Company in Wisconsin to connect its Milwaukee plants and the properties of the Wisconsin Traction, Light, Heat & Power Company with the Peninsular Power Company's lines at Iron Mountain, Mich., went into service on Dec. 30. This transmission line, which cost approximately $2,500,000, has the highest voltage and is the longest transmission line in Wisconsin and is one of the longest in the United States outside of California. It is carried by 1,874 towers spaced 600 ft. to 1,000 ft. apart. An outstanding engineering accomplishment was the spanning of the mouth of the Fox River at Green Bay. At that point the towers are 52 ft. square at the base and 265 ft. high. The distance between the towers is 1,270 ft., the lowest wire being 160 ft. above water. Work on the line was started last February and completed in record-breaking time.

Men of the Industry

J. F. Lumsden, electrical engineer of the Nova Scotia Power Commission, has been appointed assistant chief engineer.

W. T. Bracken, who recently joined the forces of the Kewanee Public Service Company, has been promoted to the position of secretary and treasurer of that utility. Mr. Bracken was formerly associated with the Beloit Water, Gas & Electric Company.

John T. Harrington, president of the Pennsylvania-Ohio Electric Company, Youngstown, Ohio, has been elected president of the Trumbull Steel Company, Youngstown. Mr. Harrington continues as president of the Pennsylvania-Ohio company, his election to the presidency of the steel company in no way affecting his connection with that utility.

C. M. Goddard, who retired Jan. 1 after thirty-five years of continuous service as secretary of the New England Insurance Exchange, Boston, was the guest of honor at a dinner given Jan. 7 by 200 associates in the fire insurance field, who paid many tributes to his career. Mr. Goddard's intimate association with the development of the National Electrical Code, particularly in its earlier years, long since won him distinction and friends in the electrical industry.

James E. Davidson, president of the National Electric Light Association, was the guest of honor at a dinner given Dec. 30 by the Nebraska Section of that association at the Hotel Fontenelle, Omaha. More than 200 power and light men of the Middle West and members of the State Railway Commission and the City Commission attended. Compliments were paid to Mr. Davidson by Mayor Dahlman and Railway Commissioners Taylor, Randall and Browne.

C. C. Hawkey has been made president of the Wisconsin Valley Power Company, formed to take over the Antigo Electric Company and the Rhinelander Light & Power Company, recently acquired by the Wisconsin Valley Electric Company. Other officers selected to direct the activities of the company are B. F. Wilson, vice-president; C. S. Gilbert, treasurer, and Harold L. Geisse, secretary and general manager. Directors in addition to the foregoing are J. S. Alexander, A. L. Kreutzer and D. C. Everest.

William S. Schmidt, who has been connected with the Penn Public Service Corporation in Johnstown for a period of four and a half years, has severed his connection with that organization to join the Pennsylvania-Ohio Power & Light Company with headquarters at Youngstown, Ohio. Mr. Schmidt will serve in the capacity of special engineer directly under George A. Iler, chief electrical engineer of the Pennsylvania-Ohio Company. He was first employed by the Public Service company as power engineer in the new-business department, later being promoted to the position of operating department engineer and more recently to that of operating engineer in charge of maintenance and inspection of the electrical equipment in the power houses and substations of the central region.

W. J. Foster Consulting Engineer for General Electric Company

W. J. Foster, assistant engineer in the alternating-current engineering department of the General Electric Company, has been made a consulting engineer, according to an announcement by E. W. Allen, manager of the engineering department of the company. Two other changes in the alternating-current engineering department have also been made. **Earl S. Henningson** and **P. L. Alger** have been made assistant engineers. Mr. Henningsen will devote his attentions primarily to the administrative and mechanical problems, and Mr. Alger will have general responsibility for electrical designs and investigations.

W. J. FOSTER

Mr. Foster, who has been assistant engineer since the inception of the department in the spring of 1894, in his new position as consulting engineer will be available in a consulting capacity to other engineering departments as well as commercial departments, in addition to his duties as consulting engineer of the alternating-current engineering department.

Mr. Foster entered the employ of the General Electric Company in 1891 at the Lynn works and spent the next three years in research and developmental work, principally on induction motors and synchronous converters. On the formation of the engineering department in the general office at Schenectady in 1894 he went there as assistant to H. G. Reist and remained in that position until his present promotion to consulting engineer.

G. C. Wright of Petersburg (Va.) has been elected a member of the board of directors of the Virginia Electric & Power Company to succeed Chauncey W. Hood of Boston, who recently resigned.

Charles H. Howard, formerly illuminating engineer of the Commonwealth Edison Company, Chicago, has severed his connection with that utility to become secretary and treasurer of a Kentucky coal company.

W. L. Collier, formerly chief engineer of power stations of the Southwest Electric Light & Mill Company, Sarcoxie, Mo., which was recently bought by the Ozark Utilities Company, is now manager of the Sedan Electric Light & Power Company, serving Sedan, Peru, Elgin and Chautauqua.

Jay B. Odell, formerly manager for the Western Electric Company at Richmond, Va., and for the past year assistant to the president of the company, with offices in New York, has just been promoted to the office of vice-president in charge of purchases and traffic. Mr. Odell was also made a member of the board of directors.

Ray Whitson, formerly assistant district manager for the Southern California Edison Company at Santa Monica, has been appointed district manager in Lankershim to succeed D. H. Rowan, recently transferred to Visalia. Mr. Whitson first entered the employ of the Edison company in the capacity of meter tester.

Oscar C. Wright has been appointed manager of the investment department of the Kentucky Utilities Company to succeed Mrs. Florence A. Tate, who has been appointed manager of the investment department of the Interstate Public Service Company. Mr. Wright returns to Louisville from Indianapolis, where he occupied the position to which Mrs. Tate has been appointed.

A. W. McLimont, for the past eight years vice-president and general manager of the Winnipeg Electric Company, has been appointed president to succeed George W. Allen, who has resigned. Mr. McLimont has had a wide and varied experience. He was formerly electrical engineer for the Public Service Commission of the First District of New York and has held other important positions in the United States. He also constructed and operated electric systems in South America and Mexico. Mr. McLimont retains his position as general manager of the Winnipeg Electric Company. **W. R. Bawlf** of Winnipeg has been elected vice-president. **W. H. Carter** of Winnipeg and **James B. Woodyatt**, who has recently been appointed president of the Southern Canada Power Company, as announced in the last issue of the ELECTRICAL WORLD, have been elected directors.

James C. Clark, until recently associated with the Pacific Electric Manufacturing Company of San Francisco, has joined the experimental staff of the Westinghouse Electric & Manufacturing Company, materials and process engineering department, East Pittsburgh. Here he will assist in the direction of the high-voltage laboratory, engineering laboratory and the new high-power laboratory. The latter has just been completed by the Westinghouse company for research in high-capacity interrupting devices. Before going with the Pacific Electric Manufacturing Company in the spring of

1925, Mr. Clark spent a year as professor in charge of electrical engineering research at Iowa State College, and prior to that time he was for twelve years associate professor of electrical engineering at Stanford University.

B. M. Fobes, formerly owner of the Hawkins (Wis.) electric plant and distribution system recently taken over by the Lake Superior District Power Company, has been named district manager by the new owners to take charge of all of the territory east of Hawkins.

Mrs. Florence A. Tate has resigned as manager of the investment department of the Kentucky Utilities Company, of which she was formerly secretary, to become manager of the investment department of the Interstate Public Service Company of Indiana, both companies being Insull properties.

C. M. Gassaway, formerly commercial manager of the New England properties of the Associated Gas & Electric Company, with headquarters at Portsmouth, N. H., has joined the new-business department of the Penn Public Service Corporation in the capacity of power engineer. Mr. Gassaway has a background of many years' experience in the electrcial industry, including affiliation with the Great Western Power Company, the General Electric Company and the J. G. White Management Corporation.

Dean W. Taylor, for the past year assistant Western editor of the ELECTRICAL WORLD, has engaged in new-business work for the Pennsylvania Edison Company and the New Jersey Power & Light Company, with headquarters at Easton, Pa. Both companies are under the management of the W. S. Barstow Management Association, Inc. Prior to his work on the ELECTRICAL WORLD, Mr. Taylor had spent nine years in public utility work with the Central Indiana Power Company of Indianapolis, the Wisconsin-Minnesota Light & Power Company of Eau Claire, Wis.; the Public Service Company of Northern Illinois and the Consolidated Gas, Electric Light & Power Company of Baltimore. He was graduated from the College of Engineering, University of Michigan, in 1916.

W. W. Sayers, formerly chief engineer of the Philadelphia plant of the Link-Belt Company, has been appointed chief engineer of the company with headquarters at the general offices of the company in Chicago. This position, which the management has just created, carries with it the responsibility of general supervision over all engineering work, harmonizing the practice of the several plants and following up new engineering development. Mr. Sayers is admirably fitted for his new duties. He was graduated from the University of Illinois in 1897 and in his 23 years of Link-Belt experience has successfully held many important positions in the engineering, construction and sales departments of the company. **George L. Morehead**, for the past six years attached to the management of the several Indianapolis plants and who has made an enviable record for himself there as well as at the Link-Belt Chicago plant, takes on the duties of manager of the Philadelphia plant.

Puget Sound Company Announces Changes in Personnel

The following changes in duties and assignments of officials of the Puget Sound Power & Light Company have been announced by A. W. Leonard, president: E. T. Steel, manager southern district, becomes manager of the western district; A. M. Chitty, superintendent of light and power northeastern district, becomes manager of northern district; Frank Walsh, superintendent light and power eastern district, becomes superintendent of light and power northeastern district; C. H. George, assistant superintendent northern district, becomes superintendent of light and power eastern district; E. R. Nigh, assistant engineer southern district, becomes superintendent light and power western district, and W. A. White, engineer southern district, becomes general superintendent southern district.

Ray I. Carruthers, district manager of the Southern California Edison Company at Visalia since 1918, has been transferred to the company's general offices in Los Angeles as assistant sales manager. Mr. Carruthers joined the Edison company in 1910 as a lighting salesman.

D. L. Scott, formerly advertising manager of the Los Angeles Gas & Electric Corporation, has been made manager of the recently established public relations department of that company. Mr. Scott has been identified with the Los Angeles organization since 1912.

J. H. Lynch has been appointed manager of the merchandising division of the Westinghouse Electric & Manufacturing Company's New England territory, with headquarters at Boston. For the past four years Mr. Lynch has specialized at the Boston office in the sale of outdoor lighting equipment. He is well known in New England electric utility circles.

Howard Butler has been appointed local manager of the Citizens' Gas & Electric Company, Council Bluffs, Iowa, which is controlled by the Nebraska Power Company. Mr. Butler was transferred to Council Bluffs in 1915 from the Omaha Electric Light & Power Company and was made assistant manager in the summer of 1922.

Jackson P. Dick, who for the past two years has served as assistant to the vice-president and general manager of the Georgia Railway & Power Company, has been appointed assistant general manager of that company. Mr. Dick is a graduate of the University of Georgia and has been affiliated with the Georgia Railway & Power Company for more than five years.

G. F. Klein, formerly connected with the Cahokia station of the Union Electric Light & Power Company, St. Louis, has severed his connection with that utility to become chief operating engineer of the Staley Manufacturing Company of Decatur, Ill. Mr. Klein's connection with the Union company dates back to 1917, when he entered the steam-heating department as mechanical engineer. Previous to being placed in charge of the Cahokia station in 1923 he served as superintendent of isolated plants and as assistant chief engineer of the steam engineering department.

Ray L. Harrison of Aurora, Neb., has succeeded C. C. Hellmers as manager of the Maryville (Mo.) properties of the United Light & Power Company.

J. J. Daly, formerly connected with the Adirondack Power & Light Company, Schenectady, N. Y., has affiliated himself with the Connecticut Light & Power Company, Waterbury, Conn., where he will be in charge of the merchandise sales department.

D. H. Rowan, formerly district manager of the Southern California Edison Company in Lankershim, has been transferred to Visalia in the same capacity to succeed Ray I. Carruthers, who has assumed new duties in Los Angeles. Mr. Rowan entered the employ of the Edison company as a "greater service" representative in the Vernon district, later becoming district manager at Lankershim.

C. E. Bennett, formerly electrical engineer of the Georgia Railway & Power Company, has been appointed manager of the company's electrical department. Mr. Bennett was previously affiliated with a number of prominent consulting engineers, including Hugh L. Thompson of Waterbury, Conn.; Curtis A. Mees of Charlotte, N. C., and L. B. Stillwell and the J. G. White Company of New York. He is one of the country's leading specialists on the subject of lightning arrest, being the inventor of a lightning arrester nationally known under his name and of many other successful devices.

N. I. Garrison, who for the past year and a half has been southern division manager of the Oklahoma Gas & Electric Company with offices at Ada, has been promoted to assistant operating manager of all company properties in the state with headquarters at Oklahoma City. Mr. Garrison will be assistant to Frank J. Meyer, who is in charge of company operations. Mr. Garrison's selection comes as a marked recognition of his abilities and long service with the organization. He began his career in the electrical industry as an employee of the Fort Smith Light & Traction Company, which was taken over in 1904 by H. M. Byllesby & Company. Mr. Garrison was steadily promoted until in 1917 he was made manager of the Oklahoma Gas & Electric Company at El Reno, later becoming division manager at Ada. Other promotions announced by the company are those of **Roy D. Weldy** from manager at Wewoka to manager at Ada and **R. F. Danner** from assistant general superintendent of the company to superintendent.

Obituary

Benjamin H. Ryder, electrical engineer of the American Steel & Wire Company for the past 24 years, died suddenly Dec. 26. He was widely known in electrical and railroad circles of the country. Mr. Ryder was a native of Hudson, N. Y., and was 48 years of age.

Commission Rulings

Real Estate Interests with Generating Plant in One Building May Not Erect Wires in Occupied Territory to Serve Its Other Houses.—The New York Public Service Commission last week by a vote of three to two affirmed its original order, adopted June 4, 1925 (see ELECTRICAL WORLD, June 13, page 1286), granting the application of the Lawrence Park Heat, Light & Power Company for authority to make steam-plant extensions in Bronxville, but denying the application as to electric plant extensions. The applicant has a heating and lighting plant in the Hotel Gramatan, which it owns, and desired to carry electricity by wire to apartment houses it was building in the neighborhood. The Westchester Lighting Company, which already has poles and wires in the streets affected, objected, saying that by so doing the Lawrence Park company would enter its territory and obtain the cream of the business. The commission held that no evidence was offered either upon the rehearing or at the original hearing sufficient to warrant a change in the original determination. It held that extension of the petitioner's electric wires to serve the real-estate developments of the Lawrence Investing Company, of which it is a subsidiary, would result in unjust and wasteful competition with the Westchester Lighting Company and unnecessary duplication of equipment and investment. The majority opinion points out that the company is at liberty to light its properties by private plant on the premises or by installing electric generators on each property driven by steam furnished from its own central station and is not required to buy energy from the Westchester Lighting Company. It adds: "The commission is clearly of the opinion that a case of public convenience and necessity for a new electric line is not made out by the mere allegations of a real-estate corporation that it will not in any event permit its tenants to take current from the existing concern."

Mining Company Selling Surplus Power in Bulk Only Not a Public Utility.—A power company which had not professed public service, although it rendered service to a distributing utility, was held by the Montana Public Service Commission not to be a public utility. The commission said: "The Montana Water & Power Company is a corporation organized under the laws of Montana. In its charter there are no provisions expressly undertaking any public service subject to the jurisdiction of this commission, and such inferences as may be drawn from the words there found relate to an electric railway service as the only probable public undertaking. The corporation is controlled by . . . a corporation engaged in mining. The light and power company seems to be a corporate device for the more convenient financial operation of the power units employed primarily for mining operations. Beyond question the only electrical energy offered for sale is the varying surplus. . . . At the present time it appears that surplus energy is sold by respondent to two corporations. . . . The respondent company is not serving the inhabitants of the town of Troy, nor does it enjoy any franchise from the town to serve its inhabitants, nor has it exercised any prerogative of the state in the construction of its plant, or in the sale of its product. . . . The fact that respondent sells to a public utility [the Kootenai Light & Power Company] is of no consequence in the absence of corporate identity between seller and buyer."

Recent Court Decisions

Federal Water-Power Act Not an Encroachment on State's Rights.—In refusing to entertain the bill brought by the State of New Jersey against the federal water-power act, the United States Supreme Court overruled all the contentions of unconstitutionality and infringement on the rights of the state that were raised by the petitioner. Concerning these allegations it said in part: "There is no showing that the state is now engaged or about to engage in any work or operations which the act purports to prohibit or restrict, or that the defendants are interfering or about to interfere with any work or operations in which the state is engaged. If the use of particular waters in connection with the Morris Canal or with any reservoirs and waterworks before the act was passed gave rise, as the bill suggests, to a right to continue such use, the act does not purport to disturb, but rather to recognize, that right; and there is no showing that the defendants are taking or about to take any steps to prevent the state from exercising it. Passing that right, the state is merely shown to be contemplating power development and water conservation in the future. There is no showing that it has determined on or is about to proceed with any definite project. Neither is it shown that the defendants are now taking or about to take any definite action respecting waters bordering on or within the state, save as the commission is about to consider and act on 'various applications from persons in New Jersey' for preliminary permits and licenses to utilize 'navigable waters on the boundary and inland' for the development of water power. As the applications are not further described, it must be assumed that the permits are sought, as the act provides, 'for the sole purpose of maintaining priority of application for a license,' and that the licenses are sought conformably to the provision requiring applicants to submit satisfactory evidence of compliance with the laws of the state with respect to 'the appropriation, diversion and use of water for power purposes' and to 'the right to engage in' that business. While the state is thus apparently put in the position of objecting to the licensing of projects sanctioned by its own laws, the bill explains that the objection is chiefly to the restrictions and conditions to which, according to the terms of the act, an applicant is deemed to assent by seeking and accepting a license. These restrictions and conditions are assailed in the bill as passing beyond the field of congressional power and invading that reserved to the state. But whether they are thus invalid cannot be made the subject of judicial inquiry until they are given or are about to be given some practical application and effect. Naturally this will be after they become part of an accepted license, and after some right, privilege, immunity or duty asserted under them becomes the subject of actual controversy. As respects the state's submerged lands, the bill signally fails to disclose any existing controversy within the range of the judicial power. Stating merely that the state will be deprived of revenue from the leasing of such lands is not enough. Facts must be stated showing that the act is being or about to be applied in a way which does or will encroach on or prejudicially affect the state's qualified right in the lands. There is no such showing."

Responsibility of Electric Company for Dangerous Guy Wire Belonging to Another.—Smith vs. St. Joseph Railway, Light, Heat & Power Company et al. was a damage suit brought against the electric company, a dairy company and a manufacturing company for the death of an employee of the first named. While assisting in remedying conditions caused by a transformer burn-out this man stood on a guy line attached to one of the company's poles and stretching to a smokestack of the dairy company. The dairy company owned the guy wire, which was uninsulated and had been so installed by the manufacturing company, and which completed a circuit when the victim of the accident, standing upon it, came into contact with a dangling transmission wire of the electric company cut because of the transformer trouble. Each of the three companies pleaded that it was not responsible for the accident, the dairy and the manufacturing companies claiming that the guy wire was not the proximate cause of death, the manufacturing company claiming in addition that it had installed the guy wire according to instructions, and the electric company maintaining that the guy wire had been strung without its knowledge or consent. Contributory negligence was also set up. The trial jury awarded damages in the sum of $10,000 against the three companies, the trial court refusing, however, to allow it to assess them in the proportion of $6,000 against the electric company, $3,000 against the manufacturing company and $1,000 against the dairy company. The Supreme Court of Missouri has sustained the verdict, overruling all the demurrers and maintaining that the dangerous condition should have been apparent to all the companies, since the electric company had a pole constantly climbed by repairmen in close proximity to the guy wire. The court observed that danger might have been avoided by a strain insulator in the guy wire. (276 S. W. 607.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Improves

Lehigh Power Securities Shows Marked Rise on Rumors of Split-up in Its Shares

CONTINUED ease in the general money situation has had an influence on the prices of stocks in all groups. Although no very pronounced advances have been made yet this year on the New York Stock Exchange, the tone for the most part has reflected a degree of firmness that is significant. The market in power and light stocks has benefited, too, of course, from the large volume of reinvestment funds that has been flowing into the market.

One of the more interesting developments of the recent market in electric issues has been the increasing interest in the shares of so-called investment trust utility issues. Improvement in price and increased activity in Electric Investors, Inc., in Utility Shares Corporation and such issues as the stocks of American States Securities indicate this trend.

On the New York curb interest last week centered in the extraordinary and persistent strength in Lehigh Power Securities, which rose smartly to a new record high on rumors of various descriptions. Reports have it that the time is near when Lehigh Power Securities will split its shares into smaller units, and there is another report that persists to the effect that United Gas & Electric will be absorbed by Lehigh, at least in part.

Among the less active issues, perhaps the best gain of the week was that scored by Eastern Texas Electric, which improved its position by eleven points. Other gains were the preferred issues of such companies as Alabama Power, Adirondack Power & Light, American Gas & Electric and American Power & Light. Eastern States Power issues rallied. Georgia Railway & Power, which has moved forward on rumors that this company will be taken over soon by Southeastern Power & Light, added another three points to its position.

New Capital Issues

The Florida Power & Light Company, the organization of which is discussed elsewhere in this issue, floated a thirty-million-dollar offering of first mortgage gold bonds at 93½ and accrued interest, to yield 5.45 per cent. During the week the Pennsylvania Power & Light Company made an offering of first and refunding mortgage gold bonds, series D, at 98½ and interest, to yield 5.10 per cent, a piece of financing involving a total of $10,000,000.

The Columbus Electric & Power Company, which participated in last week's financing, issued this week 7 per cent cumulative preferred stock, series B, to the amount of $2,500,000, the price being 100 flat, to yield 7 per cent.

The Penn Central Light & Power Company issued cumulative preferred stock—five-dollar series, no par value—at $73 per share and accrued dividend, to yield about 6.85 per cent. The newly organized Electric Refrigeration Corporation made an offering of ten-year 6 per cent convertible gold notes, totaling $3,000,000, the price being 99½ and accrued interest, yielding over 6 per cent.

Industry in Florida Steps Forward

Florida Power & Light Company, Just Formed by American Power & Light Interests, Is Building a Compact Financial Structure

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post.*

ORGANIZED only three weeks ago, the Florida Power & Light Company is one of the most important newcomers to be added to the list of utilities affiliated with the Electric Bond & Share group. Florida Power & Light Company is the holding company in which the American Power & Light Company has just merged or consolidated its various subsidiary properties in our most southerly state. The management has succeeded in drawing together the loose ends of a financial nature in order to set up a structure of modern design as a basis for the sale of $30,000,000 5 per cent first mortgage bonds of 1954.

TERRITORY SERVED BY FLORIDA POWER & LIGHT COMPANY AND ASSOCIATED COMPANIES

The newly organized Florida Power & Light Company owns and operates electric power and light properties in many sections of the state, not to mention gas and ice systems. Its properties include those formerly found in the following groups: Miami Electric Power & Light Company, Miami Gas Company, Miami Beach Electric Company, Southern Utilities Company, Daytona Public Service Company, Ormond Supply Company, Lakeland Gas Company, St. John's Electric Company and Southern Holding Company. It also controls through stock ownership the companies that own and distribute water in Miami and Stuart and the Miami Beach Railway Company.

That the company is able to earn its charges by a comfortable margin may be seen from the fact that, after making all necessary deductions from its annual gross earnings of more than $8,500,000, interest charges on the bonds presently to be outstanding are being earned over two and a quarter times. Business in the territory served is growing at a rapid rate, and plans already have been made for substantial increases to the generating capacity. Plants now operated represent an aggregate generating capacity of 69,513 kw., but construction has been started on two additional plants which, it is said, will be among the largest and most modern in the entire South. One of these is to be located on the St. John's River near Sanford and the other on the New River near Fort Lauderdale. Generating plants of the system now in operation are at Miami, Miami Beach, West Palm Beach, Daytona Beach, St. Augustine and Bradenton.

Through a comprehensive plan for an interconnection ultimately of its various properties, the Florida Power & Light Company expects to introduce economies that will benefit the communities served and swell net earnings. As the first step in this plan the various electric generating stations and distributing systems on the lower east coast have been interconnected by a 66,000-volt transmission line, 120 miles in length. Various stations and distributing systems in the northern part of the state, as well as those in the southwestern part of the state, are now being tied together.

Engineers' Public Service Seeks Control of Texas Utility.—According to an announcement by C. W. Kellogg, president, the Engineers' Public Service Company has made an offer to common stockholders of the Eastern Texas Electric Company to acquire their stock on

the basis of one and one-half shares of common and three-quarters of a share of $7 dividend preferred stock of Engineers' Public Service for each share of Eastern Texas Electric common. The plan has already been approved by the directors of the Eastern Texas company and by holders of a large proportion of the common stock.

Recent Increases in Stock.—The following changes in capital set-up have recently been made: (a) The stockholders of the Milwaukee Electric Railway & Light Company have increased the authorized preferred stock from $20,000,000 to $40,000,000 and the common stock from $20,000,000 to $40,000,000, and have changed the par value of the common stock from $100 per share to $20 per share. (b) The stockholders of the Pacific Lighting Corporation have increased the authorized capital stock from $20,000,000 ($10,000,000 of 5 per cent preferred and $10,000,000 common) to $100,000,000, to consist of $25,000,000 in 6 per cent cumulative preferred, $5,000,000 in 5 per cent cumulative preferred and $70,000,000 in common stock. (c) The Staten Island (N. Y.) Edison Corporation has filed a certificate at Albany, N. Y., increasing its authorized common stock from 80,000 shares to 140,000 shares of no par value.

Company Reports

The following statements of earnings have been issued by electric light and power companies for November:

Name of Company	Gross Earnings for November 1925	1924
Alabama Power	$1,065,065	$874,615
Bangor Hydro-Electric	136,360	125,517
Binghamton Lt., Ht. & Pwr.	162,223	133,434
Brazilian Traction, Light & Power, Ltd	2,911,695	2,346,029
Central Illinois Light	361,278	325,924
Commonwealth Power	4,095,871	3,476,995
Consumers Power	1,946,898	1,585,541
Florida Public Service	105,207	64,528
Georgia Railway & Power	1,397,553	1,608,885
Kansas City Power & Light	950,437	828,186
Metropolitan Edison	802,329	695,976
New Jersey Power & Light	136,241	104,728
North Carolina Pub. Service	165,379	158,667
Northern Ohio Power	1,009,527	894,569
Ohio Edison	156,018	135,194
Pennsylvania Edison	276,026	247,982
Philadelphia Co. & af. corp.	5,580,823	4,946,747
Republic Railway & Light	1,007,601	33,534
Sayre Electric	25,960	21,211
Southern California Edison	2,044,489	1,772,265
So. Indiana Gas & Elec.	239,306	226,843
Tennessee Electric Power	1,021,657	887,754

Stone & Webster properties:

Baton Rouge Electric	$ 74,776	$64,474
Blackstone Valley Gas & El.	473,021	428,490
Cape Breton Electric, Ltd.	53,109	56,779
Columbus Electric & Pwr.	265,829	209,963
Edison Electric Illuminating of Brockton	153,916	149,301
Electric Light & Power Co. of Abington & Rockland	48,234	38,855
El Paso Electric	224,312	210,708
Galveston-Houston Electric	330,322	336,144
Houghton Co. Electric Lt.	46,680	45,928
Key West Electric	25,322	20,418
Lowell Electric Light	154,098	148,539
Northern Texas Electric	205,049	224,211
Puget Sound Power & Light	1,139,010	1,092,560
Savannah Electric & Power	177,661	166,495
Sierra Pacific Electric	94,722	100,500
Tampa Electric	347,368	217,277

New England Company Expansion Plan Approved. — Stockholders of the New England Company at a meeting on Jan. 6 approved the plan of reorganization and enlargement recently proposed by the directors.

Nine Hundred per Cent Stock Dividend.—Directors of the Central States Electric Corporation declared a 900 per cent dividend payable Feb. 8 to common stock holders of record Jan. 30. Declaration of the dividends followed an increase in common stock from 150,000 shares to 1,500,000 shares.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Jan. 9	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	*f* 71½	*m* 71½	*m* 74½
Adirondack Pwr. & Lt.—7% pf.	101½	98	106
Adirondack Pwr. & Lt.—8% pf.	108	103	115
Adirondack Pwr. & Lt., com.—50	*l* 75	31	98
Ala. Pwr., pf.	103	97½	106
Allis-Chalmers Mfg. pf.	*j*109½	*m* 109	*m* 110
Allis-Chalmers Mfg., com	*j* 94½	*m* 90½	*m* 94½
Amer. & Foreign Pwr., pf. 25% pd.	128½	114½	142
Amer. & Foreign Pwr., 7% pf.—no par	*j*91	*m* 91	*m* 92
Amer. & Foreign Pwr., com.—no par	*j* 40½	*m* 40	*m* 42½
Amer Bosch Magneto, com.—no par	*j* 32½	*m* 30½	*m* 34½
Amer. Brown, Boveri, ptc., stk.	*j* 47½	*m* 47	*m* 48½
Amer Elec. Pwr., pf.	*c* 101½	91	104½
Amer. Gas & Elec., 6% pf.—no par	93	85	93
Amer. Gas & Elec., com.—no par	84	70	85
Amer. Lt. & Trac., 6% pf.	114	93	119½
Amer. Lt. & Trac., com.	238	139	288
Amer. Pwr. & Lt., 6% pf.	95	84	95
Amer. Pwr. & Lt., com.—no par	74	52	67½
Amer. Pub. Serv., 7% pf.	96½	88	96
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	82	....	....
Amer. Pub. Utilities, 6% pf.	81	71	82
Amer. Pub. Utilities, 7% pf.	86	87	95
Amer. Pub. Utilities, com.	79	70	103
Amer. Superpwr., pf.—25	25½	24½	27½
Amer. Superpwr., Class A—no par.	*j* 35	....	....
Amer. Superpwr., Class B—no par.	*j* 37	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	103½	97½	103
Amer. Wtr. Wks. & Elec., com.	*j*70	*m* 68½	*m* 74
Appalachian Pwr., 7% pf.	99	92	100
Appalachian Pwr., 1st pf., 7%	100	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	83	75	87
Arizona Pwr., com.	28	15	34½
Arkansas Cent. Pwr., pf., $7—no par	101½	97	102
Arkansas Lt. & Pwr., 7% pf.	98	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	*k*101½	*m* 100½	*m*102½
Assoc. Gas & Elec., 7% pf.—1% extra—50	*j* 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	*j* 80	....	....
Assoc. Gas & Elec., Class A	*j* 32½	....	....
Babcock & Wilcox, com.	*j* 148	....	....
Birmingham Elec. pf.—$7—no par.	101	98	103
Blackstone Valley Gas & Elec., com.—50	95	95	100
Blaw-Knox, com.	*l* 54	59	60
Brazilian Trac., Lt. & Pwr., com.	*j* 84	....	....
Broad River Pwr., pf.	93	90	97
Brooklyn Edison, com.	*j*136½	*m* 133½	*m*136½
Buffalo Gen. Elec., com.—no par.	*l* 58	50	77
Buffalo, Niagara & East. Pwr., pf.—25.	*k* 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	*k*36½	....	....
Carolina Pwr. & Lt., pf.—$7—no par	105	100	107
Carolina Pwr. & Lt., com.	420	250	456½
Central & S. W. Utilities, 7% pf.—no par	*a* 90	88	92½
Central & S. W. Utilities, pr. In. pf.—no par	98	92½	100
Central Ariz. Lt. & Pwr., pf.	101	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	87	84	93
Central Ind. Pwr., 7% pf.	88	88	95
Central Pwr. & Lt., pf.	95	88	96½
Central States Elec., 7% pf.	93	87	98
Central States Elec., com.	210	70	250
Century Elec. com.	*l*103	103	110
Chicago Fuse Mfg., com., no par	*a* 32½	27½	39½
Cincinnati Gas & Elec., com.	*g* 89½	82	90
Cities Service, 6% pf.	84	80	84
Cities Service, pf. B—10	*j* 71	....	....
Cities Service, pf. BB—100	*j* 77	....	....
Cities Service, com.—20	38	34	43
Cities Service, Bks. Shrs.—10	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	*j*115	*m*114	*m*115
Columbia Gas & Elec., com.—no par	*j* 88½	*m* 83½	*m* 90
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	*j* 98½	....	....
Columbus Elec. & Pwr., com.	*j*148	....	....
Columbus Ry., Pwr. & Lt., pf. A	98	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr., & Lt., com—no par	82	70	85
Commonwealth Edison, com.	*a*142	130½	141½
Commonwealth Pwr., 6% pf.	86	80	88
Commonwealth Pwr., com—no par.	41	30½	43½
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	110	105	110
Cons. Gas of N. Y., pf.—50	58	56	60½
Cons. Gas of N. Y., com—no par	*j* 99½	*m* 94½	*m*100
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	*c*102	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	*c*108½	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	*c*110½	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	*c*124½	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	*c* 47	32	47½
Cons. Utilities of Dela., 7% pf.	*l* 85	80	84
Consumers Pwr., 6% pf.	96	90	97
Consumers Pwr., 6.6% pf.	101	97	102
Continental Gas & Elec., 7% ptc. pf	95	85	97
Continental Gas & Elec., 7% pr. pf.	94½	89	97
Continental Gas & Elec., com—no par	125	77	152
Crocker Wheeler, com.	9	9	28
Crocker Wheeler, pf.	48	47	80
Dallas Pwr. & Lt., 7% pf.	102½	100	102½
Dayton Pwr. & Lt., 6% pf.	95	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com., ex. div.	*j*136½	*m*133	*m*137½
Dubilier Condenser & Radio, com.	*j* 8½	....	....
Dubuque Elec., 7% pf.	93	80	90
Duquesne Lt., 7% pf.	112½	104	112
East. Tex. Elec., 7% pf.	100	100	105
East. Tex. Elec., com.—no par.	83	70	75½
Edison Elec. Illum. of Boston, com.	*d*209½	200	213
El Paso Elec., com.	*j* 79	....	....
El Paso Elec., pf.	*j*101	....	....
Elec. Bond & Share, 6% pf.	*k*104	*m*103½	*m*105
Elec. Bond & Share Sec., com.—no par	*k*80	*m*79	*m* 86
Elec. Investors, 6% pf.—no par	48	95	96
Elec. Investors, com.—no par	68	30	79½
Elec. Investors, 10% pd. receipts	42	15	62
Elec. Pwr. & Lt. ctfs. pf.	*j* 91½	*m* 91	*m*92½
Elec. Pwr. & Lt., ctfs. 40% pd.	105½	*m* 105½	*m*107½
Elec. Pwr. & Lt., ctfs. full pd.	105½	*m*100½	*m*110½
Elec. Pwr. & Lt., ctfs. com.	*j*31½	*m*30½	*m*32½
Electric Refrigeration, w. i.	*k*90	....	....
Elec Ry. Securities, com—no par	5	....	....
Elec. Storage Battery, com.—no par	*j* 74½	*m* 73	*m* 75
Elmira Wtr., Lt. & R.R., 7% pf.	96	93	98
Emerson Ele., pf.	*l*101	95	101½
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.—no par.	100½	100	103
Engr. Pub. Serv., com.—no par.	28½	19½	30
Eureka Vacuum Cleaner, com.—no par	*j* 53½	*m* 52½	*m*53½
Fairbanks Morse, com.	*j* 54	*m* 51	*m* 51
Fairbanks Morse, pf.	*l*108½	106½	110½
Federal Lt. & Trac., com.	*j* 38½	*m* 36	*m* 39
Federal Light & Traction, pf.	*l*85½	82½	86
Federal Utilities, pf.	*j* 75	....	....
Federal Utilities, com.	*l* 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	*k*105½	*m*105	*m*107
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	25	20	40
Gen. Elec., com.	*j*347½	*m*323	*m*347½
Gen. Elec., special—10	*j* 11½	*m* 11	11½
Gen. Gas & Elec., 6% pf.—no par.	*l*100	72	240
Gen. Gas & Elec., 7% pf.	*l*100	120	175
Gen. Gas & Elec., com.—no par.	*l*100	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	*l*100	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par.	*l*107	104½	180
Gen. Gas & Elec. (Del.) com. A no par.	58½	42	64½
Gen. Gas & Elec. (Del.) com. B no par.	43	40	62
Gen. Gas & Elec. (Del.) A pf. $8 no par.	109	90	111
Gen. Gas & Elec. (Del.) A pf. $7 no par.	98	97½	100
Gen. Gas & Elec. (Del.) B pf. $7 no par.	95	97½	100
Ga. Lt., Pwr., & Rys., 6% pf.	75	74	85
Ga. Lt., Pwr. & Rys., com.	59	25	74
Ga. Ry. & Elec., 5% pf.	*l* 70	78½	84½
Ga. Ry. & Elec., com.	*l*126	115½	115½
Ga. Ry. & Pwr., 8% pf.	112	101	114
Ga. Ry. & Pwr., 7% pf.	100½	100	102½
Ga. Ry. & Pwr., 4% pf.	148	62	150
Ga. Ry. & Pwr., com.	148	62	154
Gt. Western Pwr., 7% pf.	*k*101	....	....
Havana Elec. Util., com.	44	42	45
Havana Elec. Util., pf.	69	66	70½
Hurley Machine, com.—no par.	*a* 47½	41½	56
Idaho Pwr., 7% pf.	101½	97½	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	96½	92½	98
Int. Combustion Engr., com.—no par.	*j* 59½	*m*56½	64½
Int. Utilities, class A—no par.	*j* 37½	....	....
Int. Utilities, class B—no par.	*j* 8	....	....
Interstate Pwr., pf., $7, no par.	91½	90	98
Interstate Pub. Serv., 7% pf.	96½	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	94	90	96
Jersey Central Pwr. & Lt., com.—no par	45	15	50
Johns-Manville, com.—no par.	*j*155	....	....
Kansas Gas & Elec., 7% pf.	*k*100½	*m* 99½	*m*102
Kelvinator Corp., com.—no par.	*j*87½	....	....
Kentucky Hydro-Elec., pf.	*a* 94	85½	94
Kentucky Sec., 6% pf.	75	67	78
Kentucky Sec., com.	90	77	100
Kentucky Utilities, 6% pf.	89	82	95
Keystone Pwr. & Lt. 7% pf.	94½	90	95
Kings County Ltg., 7% pf.	101	98	101
Kings County, Ltg., 8% pf.	104	103	106
Laclede Gas Lt., com.	*j*161	*m*161	*m*163½
Lehigh Pwr. Sec., cap.—no par.	210	82	196
Long Island Ltg., 7% pf.	104½	100	105
Long Island Ltg., com—no par.	145	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par.	32	28½	49½
Maytag Mfg., com.	*j* 22	*m*21½	*m*22½
Memphis Pwr. & Lt., pf., $7, no par.	103	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	96
Metropolitan Edison, pf., $7, no par.	*l* 102	100	110
Middle West Utilities, 7% pf.	*a* 98	91½	99
Middle West Utilities, 7% pr. lien pf.	*a*107½	98	108

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh. *j*Bid, low, high, Tuesday, Jan. 12. *k*Bid, low, high, Wednesday, Jan. 13. *l*Latest quotations available. *m*1926.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Jan. 9	Low 1925	High 1925
STOCKS—Continued			
Middle West Utilities, com.—no par	a124	92¼	125
Midland Utilities, pr. in. pf.	a 99	98½	101
Midland Utilities pf. A	a 96	92	97
Milwaukee Elec. Ry. & Lt., 8% pf.	100	95	105
Milwaukee Elec. Ry. & Lt., 7% pf.	98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	87	83½	87
Minn. Pwr. & Lt., 7% pf.	k101¼	m100¼	m102
Miss. Pwr. & Lt., pf.	j102	....	....
Miss. River Pwr., 6% pf.	94	87½	94
Miss. River Pwr., com.	50	37	124½
Montana Pwr., pf.	l112½	109	117
Montana Pwr., com.	j82½	m 78½	m82½
Montreal Pwr., com.	f 215	....	....
Mountain States Pwr., pf.	j 94	....	....
Mountain States Pwr., com.	j 25	....	....
National Carbon, com.	l124	120	130
National Carbon, pf.	l137½	120	137½
National Elec. Pwr., pf.	90	92	97½
National Lt., Ht. & Pwr., 5% pf.	70	40	72
National Lt., Ht. & Pwr., com.—no par	20	11	30
National Pwr. & Lt., pf., $7—no par	101	95	99
National Pwr. & Lt., com.—no par	500	185	467
National Pub. Serv., 7% pf.	90	90	96
National Pub. Serv., pfc. pf.	93½	93	97½
National Pub. Serv., A com.—no par	j 22½	....	....
National Pub. Serv., B com.—no par	j 13½	....	....
Nebraska Pwr., 7% pf.	k104	m103	m105
Nevada-Calif. Elec., com.	j 35	....	....
N. J. Pwr. & Lt., 7% pf.	104	92	102
New Orleans Pub. Serv., 7% pf.	100	94	102
New Orleans Pub. Serv., com.—no par	l 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	28	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	l106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par	l 60½	60	73
NizerCorp., A.—no par	l 84½	37	84½
NizerCorp., B.—no par	j 88	....	....
No. Amer., 6% pf.—50	j50½	m 49	m50½
No. Amer., com.—10	j 64½	m 63½	m65½
No. Caro. Pub. Serv., pf.—$7—no par	91	90	96
No. N. Y. Utilities, 7% pf.	j102½	....	....
No. Ohio Pwr., com.—no par	16	5	19
No. Ohio Trac. & Lt., 6% pf.	75	64	75
No. Ont. Lt. & Pwr., pf.	75	68	78
No. Ont. Lt. & Pwr., com.	59	41	52
No. States Pwr., 7% pf.	99½	95	100
No. States Pwr. com.	130	103	144½
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Brass, class B—no par	74	72	79
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	93	85	95
Ohio Pub. Serv.: 7% pf.	98	97	100
Ohio River Edison, 7% pf.	97½	93½	100½
Oklahoma Gas & Elec., pf.	j 95	....	....
Pacific Gas & Elec., 6% pf.	96½	92	99
Pacific Gas & Elec., com.	l127	m127	m130
Pacific Pwr. & Lt., 7% pf.	k99	m 99	m101
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	c 73½	60	73
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	96	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	105	101	110
Penn Pwr. & Lt.-$7-no par	k104½	m103	m105
Penn Pub. Serv., 7% pf.	98	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., com.	e161	126½	185
Phila. Co., (Pitts.) pf.—50	c 48	37½	49½
Phila. Co., (Pitts.) com.—50	j 64½	m63½	m70½
Phila. Elec., com.	c 57½	37½	58
Pittsburgh Utilities, pf.	j 16	m 15½	m16½
Portland Elec. Pwr., 7% pf.	97	95	99
Portland Elec. Pwr., 6% pf.	72	70	80
Portland Elec. Pwr., com.	37	40	53
Portland Ry., Lt. & Pwr., pf.	l 72	....	....
Portland Ry., Lt. & Pwr., com.	l 41	....	....
Pwr. Corp. of N. Y., 7% pf.	l110	96	112
Pwr. Corp. of N. Y., com—no par	83	15	89½
Pwr. Sec., pf.—no par	23	10	55
Pwr. Sec., com.—no par	7	8	30
Pub. Serv. of N. J., 7% pf.	j103½	m103½	m105½
Pub. Serv. of N. J., 8% pf.	j115½	m115½	m115½
Pub. Serv. of N. J., com—no par.	j 85½	m 79½	m 85½
Pub. Serv. of No. Ill., 6% pf.	a101½	92	101
Public Serv. of No. Ill., 7% pf.	a112	102	111
Pub. Serv. of No. Ill., com.—no par	a130½	107½	132½
Pub. Serv. of No. Ill., com.	a131	116	131
Pub. Serv. of Okla., 7% pf.	92	87	95
Pub. Serv. Elec. & Gas, 6% pf.	l 98½	92½	100½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	j 84	....	....
Puget Sound Pwr. & Lt., com.	50	49	61
Radio Corp., of Amer., pf.—50	j 46½	m 42	m 46½
Radio Corp. of Amer., com.—no par	j 46	m 45½	m 46
Republic Ry & Lt., pf.	95	70	93
Republic Ry. & Lt., com.	74	49	67
Rochester Gas & Elec., 5% pf.	95	80	93
Servel Corp., Class A	j 29½	....	....
Servel Corp., Class B—no par	58	35	62½
Sierra Pacific Elec., com.	j 25	....	....
Sioux City Gas & Elec., 7% pf.	98	97½	99½
Southeastern Pwr. & Lt., 7% pf.—no par	98	90	100
Southeastern Pwr. & Lt., com—no par	45	28	43½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110	105	107½
So. Calif. Edison, 6% pf.	97½	90	95½
So. Calif. Edison, com.	138	102	149
Southern Cities Utilities, 7% pf.	86	77	100
Southern Cities Utilities, com.	45	30	71
Southern Pwr. & Lt. of Md., pf.	j107	....	....
Southern Pwr. & Lt. of Md., com.	j 32	....	....
Southwestern Lt. & Pwr., A	52	52	56
Southwestern Lt. & Pwr., B	42	31½	42½
Southwestern Lt. & Pwr., 6% pf.	78	....	90
Southwestern Pwr. & Lt., 7% pf.	100	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	j 56	m 54½	m 56½
Standard Gas & Elec., 7% pf.	99	96	100
Standard Gas & Elec., com.—no par	j 57½	m 55½	m58½
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superhester. com.—No par	140	120	152
Tampa Elec., com.	290	200	290
Tenn. Elec. Pwr., 6% pf.	85	80	87
Tenn. Elec. Pwr., 7% pf.	99	93	103
Tenn. Elec. Pwr., pf.—$6—no par	l 80	72	84
Tenn. Elec. P wr., com.—no par	l 65	....	....
Tex. Pwr. & Lt., 7% pf.	k103	m102	m104
Tide Water Pwr., 6% pf.	99	98½	103
Timken Roller Bearing, com.	j 54½	m53½	m56½
Toledo Edison, 8% pf.	111	109	114
Toledo Edison, 7% pf.	101	94	101½
Toledo Edison, com.	l 25	21	25
Tri-City Ry. & Lt., 6% pf.	87	82	85
United Gas & Elec., 6% pf.	92	80	94
United Gas & Elec., com.—no par.	58	26	57½
United Gas & Elec. (N. J.), 5% pf.	65	55	65
United Gas Impr.—50	c123½	79½	124½
United Lt. & Pwr., pf.—$4—no par	49	41	51
United Lt. & Pwr., pf.—$6.50—no par	89	83	99
United Lt. & Pwr., com., A—no par	131	42	166½
United Lt. & Pwr., com., B—no par	150	49	100
Utah Pwr. & Lt., 7% pf.	k101	m 99	m102
Utica Gas & Elec., 7% pf.	103½	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	92	90	97
Utilities Pwr. & Lt., com. B—no par	16	12	22
Vermont Hydro-Elec., 7% pf.	94	87	96
Virginia Pwr., 7% pf.	100	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	l149	64½	150
Wagner Elec., pf.	b 85	83½	85
Wagner Elec., com.—no par	b 33½	33½	34½
Washington Wtr. Pwr., com.	130	110	140
West Mo. Pwr., 7% pf.	j 91	....	....
West Penn., 7% pf. tem. ctf	96½	94	100
West Penn. com.	123	97	145
West Penn Elec., pf. A—$7—no par	88	88½	90
West Penn Elec., class A, ctfs.	l 89	84½	89
West Penn Elec., pf.	l 97	97	97
West Penn Pwr., pf.	k109½	m109	109½
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50	43½	38	47
Western Pwr., 7% pf.	95	84	....
Western Pwr., com.—no par	80	34	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	j 19½	....	....
Westinghouse Elec. & Mfg., com.—50	j 74½	m 73½	m75½
Weston Elec. Instrument, Cl. A	j 28½	m 27½	m28½
Weston Elec. Instrument, com.	j 17	m 16½	m17½
Wis.-Minn. Lt. & Pwr., 7% pf.	l 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	76½	76	88
Worthington Pump, pf. B	62½	58	76½
Worthington Pump, com.	j 42½	m 42	m 44½
Yadkin River Pwr., 7% pf.	k103	m102	m105
Yale & Towne, com.—25	j 64½	62	70½
BONDS			
Abitibi Pwr. & Paper	6s 1940	100	98	101½
Adir. Elec. Pwr.	5s 1962	100	97½	101
Adir. Pwr. & Lt.	6s 1950	104½	102½	105½
Adir. Pwr. & Lt.	5s 1930	97	94	98
Ala. Pwr.	5s 1946	99½	96	100
Ala. Pwr.	5s 1951	96½	92½	97½
Ala. Pwr.	6s 1951	104½	101½	105½
Ala. Trac. Lt. & Pwr.	5s 1962	120	86	115½
Aluminum Co. of Amer.	7s 1933	106½	106½	107½
Amer. Bosch Magneto	8s 1936	l103	86	101
Amer. Gas & Elec.	5s 2007	91½	90	93½
Amer. Gas & Elec.	6s 2014	97½	96½	99
Amer. Pwr. & Lt.	6s 2016	95½	94	98
Amer. Pub. Serv.	6s 1942	98½	94	99½
Amer. Wtr. Wks. & Elec.	5s 1934	96½	92½	98
Amer. Wtr. Wks. & Elec.	6s 1975	94½	94	95
Anaconda Copper	6s 1929	103½	102½	104
Anaconda Copper	6s 1953	101½	99½	102
Anaconda Copper	7s 1938	105½	99½	105½
Appalachian Pwr.	5s 1941	98	96	99½
Appalachian Pwr.	6s 2024	92½	87	94½
Appalachian Pwr.	7s 1936	105½	105	106½
Arizona Pwr.	6s 1933	100	97½	101
Arizona Pwr.	6s 1947	96	90	96½
Ark. Central Pwr.	6s 1948	101	98½	102½
Ark. Lt. & Pwr.	6s 1945	103½	100	104½
Ark. Lt. & Pwr.	6s 1954	98½	92½	99½
Assoc. Gas & Elec.	6s 1965	94½	92½	99½
Assoc. Gas & Elec.	6½s 1954	100½	94½	106
Binghamton Lt., Ht. & Pwr.	5s 1946	98½	94½	99
Birmingham Elec.	6s 1954	102	99	103
Birmingham Ry., Lt., & Pwr.	4½s 1954	88½	85	89½
Broad River Pwr.	6½s 1934	100½	99	102
Brooklyn Edison	5s 1949	103½	99½	103
Brooklyn Edison	6s 1930	104½	103½	106
Buffalo Gen. Elec. 1st	5s 1939	102	100½	102½
Buffalo Gen. Elec. 1st & Ref.	5s 1939	101	100	101½
Burlington Ry. & Lt.	5s 1932	94½	90	96
Butte Elec. & Pwr.	5s 1951	100	99	100½
Calif. Gas & Elec.	5s 1937	100½	98	101½
Canadian Lt. & Pwr.	5s 1949	55	36	62
Canton Elec.	5s 1937	99½	99	100½
Carolina Pwr. & Lt.	5s 1938	100	98½	100½
Carolina Pwr. & Lt.	6s 1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s 1953	99½	98½	100½
Central Ark. Ry. & Lt.	5s 1928	99½	98½	100
Central Ga. Pwr.	5s 1938	95½	93	97
Centralill. Lt.	5s 1943	98½	94	99½
Centralill. Publ Serv.	5s 1952	89½	84½	92½
Centralill. Pub. Serv.	5½s 1950	95½	96½	98
Centralill. Pub. Serv.	6s 1944	99½	96½	101½
Centralind. Pwr.	6s 1947	98	95½	99½
Centralla. Pwr. & Lt.	6s 1944	99½	97	101
CentralN. Y. Gas & El.	5s 1941	96½	94	97½
Central Pwr. & Lt.	6s 1946	100	97½	101½
Central Pwr. & Lt.	6½s 1952	101	94	102½
Central States Elec.	5s 1926	l 99	98	102½
Chattanooga Ry. & Lt.	5s 1956	83½	81	85
Cincinnati Gas & Elec.	5s 1956	102½	98½	102½
Cincinnati Gas & Elec.	5½s 1967	103½	100½	105
Cities Service	6s 1966	93½	90	93½
Cities Service	7s B 1966	j178	111	128
Cities Service	7s C 1966	126	111	128
Cities Service	7s D 1966	101½	98½	106½
Cities Service	7s E 1966	j109½	....	....
Cities Service Pwr. & Lt.	6s 1944	94	93½	95
City Lt. & Trac., Sedalia, Mo.	5s 1952	84	74	85½
Cleveland Elec. Illum.	5s 1939	102½	100	103
Cleveland Elec. Illum.	5s 1954	101½	97½	102
Cleveland Elec. Illum.	7s 1941	110	109	111½
Colorado Pwr.	5s 1953	95½	93	96½
Columbia Gas & Elec.	5s 1927	99½	99½	101
Columbia Ry., Gas & El.	5s 1936	92½	92½	95
Columbus, Dela. & Marion Elec.	5s 1937	84	83	88
Columbus, Dela. & Marion Elec.	6s 1937	94	91	98
Columbus Elec. & Pwr.	6s 1947	j102	....	....
Columbus Ry., Pwr. & Lt.	5s 1940	97	93½	98
Columbus Ry., Pwr. & Lt6s	1941	104½	101½	105½
Commonwealth Edison.	5s 1943	102	99½	102½
Commonwealth Edison.	5s 1953	99½	98½	101
Commonwealth Edison.	5s 1954	99½	98	101
Commonwealth Pwr.	6s 1947	102½	97½	103½
Community Pwr. & Lt.	6s 1950	98	94½	99
Conn. Ry. & Ltg.	4½s 1951	91½	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s 1962	81	75½	82½
Consol. Elec.	5s 1955	97½	94	98½
Consol. Gas of N. Y.	5½s 1945	104½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s 1935	97½	95½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	e106	104½	106½
Con. Gas, Elec. Lt. & Pwr. of Balti. notes	5½s 1952	e105½	102½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s 1965	c 100½	99	100½
Consumers Elec. Lt & Pwr.	5s 1936	95	93	96½
Consumers Pwr.	5s 1936	100½	99	101
Consumers Pwr.	5s 1952	98½	90½	100
Consumers Pwr.	5½s 1954	102½	90	104½
Continental Gas & Elec.	5s 1927	99½	101	101
Continental Gas & Elec.	6s 1947	99½	98	101½
Continental Gas & Elec.	6½s 1964	98	96½	100
Continental Gas & Elec.	7s 1954	104½	99	105½
Cumberland County Pwr. & Lt.	5s 1942	95½	92	98½
Dallas Pwr. & Lt.	6s 1949	104	103	105½
Dayton Ltg.	5s 1937	100	98½	100½
Dayton Pwr. & Lt.	5s 1941	100	97	100½
Defiance Gas & Elec.	5s 1942	97	88½	97½
Denver Gas & Elec.	5s 1949	98	97½	100
Denver Gas & Elec. Lt.	5s 1951	93½	92½	97
Des Moines Elec.	5s 1938	99	98	100½
Detroit Edison.	5s 1933	101½	99½	102½
Detroit Edison.	5s 1940	102½	99½	102½
Detroit Edison.	5s 1949	100½	97½	101½
Detroit Edison.	5s 1955	100½	99½	100½
Detroit Edison.	6s 1932	l139	110½	155
Detroit Edison.	6s 1940	l107½	106½	108½
Detroit Edison.	7s 1928	l134	125	136½
Detroit Edison.	7s 1929	l138½	114	150½
Detroit Edison.	7s 1930	l134	121½	158½
Dominion Pwr. & Trans.	5s 1932	95½	95½	99½
Driver-Harris.	8s 1931	96	88	97
Dubuque Elec.	6s 1942	101½	97½	102
Duke-Price Pwr.	6s 1949	102	98½	103
Duquesne Lt.	6s 1949	106	104½	107½
Duquesne Lt.	5½s 1949	106	104	106
Durham Pub. Serv.	7s 1949	100	97½	101½
East Penn. Elec.	6s 1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s 1929	100	97½	100½
East. Tex. Elec.	5s 1942	j 95	....	....
Economy Lt. & Pwr.	5s 1956	99	98	99½
Edison Elec. Illum. of Bkln.	4s 1939	93	89	95½
Edison Elec. Illum. (N Y.)	5s 1995	102½	99½	103
El Paso Elec.	5s 1932	j102	....	....
El Paso Elec.	5s 1950	94½	95	96
Elec. Pwr. Corp. (Germany)	6½s 1950	86	85½	88½
Elmira Wtr., Lt. & R.R.	5s 1956	96	92½	97
Empire Dist. Elec.	5s 1949	91½	88½	93
Erie Ltg.	5s 1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	99	96	100
Federal Lt. & Trac.	5s 1942	93½	88	96½
Federal Lt. & Trac.	6s 1942	102½	96½	103
Federal Lt. & Trac.	6s 1954	93½	91½	94½
Ft. Smith Lt. & Trac.	5s 1936	78	76½	82½
Ft. Worth Pwr. & Lt.	5s 1931	99½	99	100½
Galveston Elec.	5s 1940	90	86½	93½
General Elec.	3½s 1942	87½	83	90½
Georgia Carolina Pwr.	5s 1952	86½	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	87	86½	90½
Ga. Ry. & Elec.	5s 1932	98½	98½	100½
Ga. Ry. & Elec.	5s 1949	92½	88	94½
Ga. Ry. & Pwr.	5s 1954	94½	89½	96
Ga. Ry. & Pwr.	6s 1947	102½	100½	103½
Ga. Ry. & Pwr.	7s 1941	105	105	107
German Gen Elec.	7s 1945	95½	92	96½
German Gen. Elec.	6½s 1940	94½	94	94½
Great Cons. Elec. Pwr (Japan).	6½ 1950	85½	85½	88½
Great Cons. Elec. Pwr. (Japan)	7s 1944	91½	87½	92
Great Falls Pwr.	5s 1940	101½	99½	103½
Great Northern Pwr.	5s 1935	99½	96	100
Great Western Pwr.	5s 1946	99	95	99½
Great Western Pwr.	5½s 1955	98½	96	99½
Great Western Pwr.	6s 1949	101½	100	102½
Great Western Pwr.	6s 1952	101½	99½	102½
Hamburg Elec.	7s 1935	94½	94½	96
Havana Elec. Ry., Lt. & Pwr.	5s 1954	92½	85½	95½
Holtwood Pwr.	6s 1954	103½	100	104½
Houston Ltg. & Pwr.	5s 1931	99½	98½	101
Houston Ltg. & Pwr.	5s 1953	94	90½	95½
Houston Ltg. & Pwr.	5½s 1954	101½	97	102½
Hydraulic Pwr.	5s 1951	100½	99½	102
Hydraulic Pwr.	5s 1950	101	100	103
Idaho Pwr.	5s 1947	96½	93	97½
Ill. Elec. Pwr.	6s 1943	102½	99½	103½
Ill. Pwr.	5s 1933	93½	93	95½
Ill. Pwr. & Lt.	6s 1953	101½	100½	102½
Ill. Pwr. & Lt.	7s 1953	103	99	104
Ind. Elec.	6s 1947	98	96	99½
Ind. Gen. Serv.	5s 1948	95½	92	97½
Ind. Lighting	4s 1958	82½	78	84
Indiana & Mich. Elec.	5s 1957	99	97½	99
Indiana & Mich. Elec.	5s 1955	95½	95	98½
Ind. Pwr.	7½s 1941	l105½	104	106

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh. jBid, low, high, Tuesday, Jan. 12. kBid, low, high, Wednesday, Jan. 13. lLatest quotations available. m1926.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday Jan. 9	Low 1925	High 1925
BONDS (Continued)				
Ind. Service	5s	1950	90½	86½ 92
Ind. Service	6s	2020	84½	73 88½
Ingersoll-Rand	5s	1935	99½	99½ 99½
Interstate Elec	6s	1933	95	95 99½
Interstate Pwr	6s	1944	*f* 97½	95 99½
Interstate Pwr	7s	1934	101	97 101
Interstate Pub. Serv	6s	1948	98½	96 100½
Iowa Ry. & Lt.	5s	1932	98½	97 99½
Intl. Pwr. Sec.	6½s	1928	*l* 99½	97½ 100
Jersey Cent. Pwr. & Lt.	5½s	1945	95½	95 98
Kansas City Pwr. & Lt.	5s	1952	100¾	95½ 102
Kansas Elec. Pwr	6s	1937	100½	97½ 102
Kansas Elec. Pwr	6s	1943	100½	97½ 102
Kansas Gas & Elec	6s	1952	101½	98½ 103½
Kansas Gas & Elec	6s	2022	91½	86½ 94½
Kentucky Utilities	6s	1949	100½	97 101½
Kings County Elec. Lt. & Pwr	5s	1937	102	99 103
Kings County Elec. Lt. & Pwr	6s	1997	120½	114½ 120½
Kings County Ltg	5s	1954	98½	89 101½
Kings County Ltg	6½s	1954	107½	103¾ 108½
Knoxville Ry. & Lt.	5s	1946	94½	88 95½
Laclede Gas Lt.	5s	1934	100½	98½ 101¾
Laclede Gas Lt.	5½s	1953	103¾	95½ 103
Laurentian Pwr	6s	1936	100	96 100½
Laurentide Pwr	6s	1936	99	96 100½
Laurentide Pwr	5s	1946	99½	97 100½
Lehigh Pwr. Sec. (notes)	6s	1927	100½	100½ 101½
Lincoln Gas & Elec	5s	1941	93	91 95½
Long Island Ltg	5s	1936	99½	98½ 100½
Long Island Ltg	6s	1954	100	99½ 102
Long Island Ltg	6s	1948	105	102 105½
Los Angeles Gas & Elec	5s	1939	100	98 101½
Los Angeles Gas & Elec	5½s	1943	98½	94 99½
Los Angeles Gas & Elec	5½s	1947	98½	96 99½
Los Angeles Gas & Elec	5½s	1949	98½	95½ 99½
Los Angeles Gas & Elec	G	1942	103½	101½ 104½
Louisiana Pwr	6s	1944	98½	97 99½
Louisville Gas & Elec	5s	1952	98½	90½ 99½
Louisville Gas & Elec	5½s	1954	102½	99 103½
Lower Austrian Hydro Elec	6½s	1944	87½	85½ 87
Luzerne County Gas & Elec	5s	1948	98	97 99½
Luzerne County Gas & Elec	7s	1944	104½	99½ 104½
Luzerne County Gas & Elec	6s	1954	102½	99 105
Madison River Pwr	5s	1935	100½	99½ 101
Manila Elec	7s	1942	102½	97½ 103
Manila Elec. Ry. & Ltg.	5s	1953	89½	85 92
Manitoba Pwr	7s	1941	103¾	98½ 104½
Memphis Pwr. & Lt.	5s	1948	*k* 99	95 99½
Metropolitan Edison	6s	1952	105	101½ 106½
Metropolitan Edison	5s	1953	97½	91½ 97½
Metropolitan Pwr	6s	1953	102½	100 105
Michigan Lt.	5s	1946	99½	97½ 100
Michigan No. Pwr	5s	1941	98	95½ 99
Milwaukee Elec. Ry & Lt.	5s	1926	99½	99½ 101½
Milwaukee Elec. Ry. & Lt.	4½s	1931	98	94½ 97½
Milwaukee Elec. Ry. & Lt.	5s	1951	98½	94 100
Milwaukee Elec. Ry. & Lt.	5s	1961	91	84½ 92½
Milwaukee Elec. Ry. & Lt.	6s	1953	102	98½ 104
Minn. Pwr. & Lt.	5s	1955	95	95 97
Minn. Pwr. & Lt.	6s	1950	104	101½ 105½
Miss. River Pwr	5s	1951	99	96½ 100
Miss. River Pwr	7s	1935	102	102 104
Mo. Edison Elec	5s	1927	*l* 99½	99½ 100½
Mobile Elec	5s	1946	*k* 97	91 98
Montana Pwr	5s	1943	100½	97½ 100½
Montgomery Lt. & Wtr. Pwr	5s	1943	*l* 93	86½ 93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97 98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	98½ 101
Montreal Pub. Serv	5s	1942	94½	89 94½
Mountain States Pwr	6s	1938	98½	96½ 100½
Nashville Ry. & Lt.	5s	1953	97½	94 99
Nashville Ry. & Lt.	5s	1958	90½	84 92
Nassau Lt. & Pwr	5s	1927	99½	98 101
Nassau & Suffolk Ltg	5s	1945	90	82 91
National Pwr. & Lt.	7s	1972	102½	97 104½
National Pub. Serv	6½s	1955	93½	94 97½
Nebraska Pwr	5s	1949	99½	97 100½
Nebraska Pwr	6s	2022	94	89½ 97½
Nevada-Calif. Elec	6s	1946	98½	96½ 100½
Nevada-Calif. Elec	6s	1950	98½	96½ 100½
New England Pwr	5s	1951	101½	100½ 103½
New Jersey Pwr. & Lt.	5s	1936	97	92½ 97½
New Orleans Pub. Serv.	4½s	1935	87	83½ 88½
New Orleans Pub. Serv.	5s	1952	91	89½ 92
New Orleans Pub. Serv.	5s	1955	90½	88½ 92½
New Orleans Pub. Serv.	6s	1949	90½	86½ 93½
N. Y. & Queens Elec. Lt. & Pwr	5s	1930	100½	99½ 101
N. Y. & Westchester Ltg	4s	2004	79½	76 81
N. Y. & Westchester Ltg	5s	1954	97½	93 98½
New York Edison	6½s	1941	115½	112 115½
New York Edison	5s	1944	102½	99½ 102
N. Y. Gas & Elec. Lt. Ht. & Pwr	5s	1948	104	100½ 104½
N. Y. Gas & Elec. Lt., Ht. & Pwr	4s	1949	89½	86 90½
N. Y. State Gas & Elec.	5½s	1962	100½	96 101½
Newport News & Hampton Ry. Gas & Elec.	5s	1944	88½	84 93
Niagara Falls Pwr	5s	1932	101	99½ 103
Niagara Falls Pwr	6s	1932	105½	103 106½
Niagara Falls Pwr	6s	1950	105½	105½ 106½
Niagara, Lock. & Ont. Pwr	5s	1954	*l* 98½	104½ 110
Niagara, Lock. & Ont. Pwr	5s	1955	99½	97½ 100
Niagara, Lock. & Ont. Pwr	6s	1958	*l*109½	104½ 110½
Norfolk Ry. & Lt.	5s	1949	95	93 96
No. Amer. Edison	6s	1952	103	96½ 104½
No. Amer. Edison	6½s	1948	104½	100½ 106
No. Amer. Lt. & Pwr	7s	1954	99½	97 100½
North Caro. Pub. Serv.	5s	1934	90½	89 93½
North Caro. Pub. Serv.	6s	1954	94	91½ 96
North Caro. Pub. Serv.	6½s	1944	99	96 100
North Shore Elec	5s	1940	99½	97½ 100
No. Calif. Pwr	5s	1948	100	98½ 100½
No. Ind. Gas & Elec	5s	1929	99	97 100½
No. Ind. Gas & Elec	6s	1952	102½	99½ 103½
Northern N. Y. Utilities	5½s	1949	100	96½ 100½
No. Ohio Trac. & Lt.	4s	1933	87	82 87½
No. Ohio Trac. & Lt.	5s	1956	83	78 87
No. Ohio Trac. & Lt.	6s	1926	99	98½ 100
No. Ohio Trac. & Lt.	6s	1947	94	91 97
No. Ontario Lt. & Pwr.	6s	1931	100	95½ 100½
No. States Pwr	6½s	1933	128½	105½ 141
No. States Pwr. (notes)	6½s	1933	103½	99½ 104½
No. States Pwr	6s	1948	102½	101 104½
No. States Pwr	6s	1941	105½	103 107½
No. States Pwr	5s	1941	98	93 99½
No. Tex. Elec	5s	1940	70	72 82½
Northwestern Elec	6s	1935	102	101½ 102½
Northwestern Pub. Serv.	6½s	1948	99½	97½ 100½
Ohio Pwr	5s	1952	93½	89½ 96
Ohio Pwr	6s	1953	103	101 104½
Ohio Pwr	6s	2024	95½	88½ 95½
Ohio Pwr	7s	1951	105½	105½ 107½
Ohio Pub. Serv	5s	1954	92	87 93
Ohio Pub. Serv	6s	1953	100½	99 101½
Ohio Pub. Serv	7½s	1946	112½	108 112½
Ohio Pub. Serv	7s	1947	110½	107½ 111½
Ohio River Edison	6s	1948	102½	98½ 104
Okla. Gas & Elec	5s	1950	92½	91½ 95
Okla. Gas & Elec	6s	1940	95½	95½ 98½
Ontario Pwr. of Niagara Falls	5s	1943	100	98 100½
Ontario Transmission	5s	1945	99½	97 99½
Ozark Pwr. & Wtr.	5s	1952	76	75 79
Pacific Coast Pwr	5s	1940	99	98 100
Pacific Gas & Elec	5s	1942	98	93½ 99
Pacific Gas & Elec	5s	1955	*l* 93½	94 95½
Pacific Gas & Elec	5½s	1952	101½	99½ 102½
Pacific Gas & Elec	6s	1941	106½	103½ 107
Pacific Lt. & Pwr	5s	1951	99½	98½ 100½
Pacific Lt. & Pwr	5s	1942	99½	98 101½
Pacific Pwr. & Lt.	5s	1930	98	98 100
Pacific Pwr. & Lt.	5s	1953	*l* 96½	....
Parr Shoals Pwr	5s	1952	94½	92½ 97
Paterson & Passaic Gas & Elec	5s	1949	100	96 100½
Penn Central Lt. & Pwr	6s	1953	103½	102 104½
Penn Edison	5s	1946	96½	93½ 97½
Penn Elec	6½s	1954	96	96 99½
Penn. Elec	6s	1955	91½	91½ 95
Penn.-Ohio Edison	6s	1950	102	96½ 98½
Penn Ohio Elec	6½s	1938	105	99½ 106
Penn Ohio Pwr. & Lt.	5½s	1954	98½	95 99½
Penn Ohio Pwr. & Lt.	6s	1939	97½	94 99½
Penn Pwr. & Lt.	5s	1952	98	95 98½
Penn Pwr. & Lt.	5s	1953	98	95 98½
Penn Pwr. & Lt.	6s	1953	104½	102½ 105½
Penn Pwr. & Lt.	7s	1951	105½	10 5½ 107
Penn Pub. Serv	5s	1954	95½	93 96½
Penn Pub. Serv	6s	1947	104	103 105½
Penn Wtr. & Pwr	5s	1940	101½	99½ 102½
Penn Wtr. & Pwr	5½s	1953	102	100 103½
Phila. Co.	6s	1944	103½	101½ 105
Phila. Co.	5½s	1938	99½	93½ 100
Phila. Co.	5s	1951	*c* 96½	93 98½
Phila. Co.	5s	1949	*l*102½	94½ 104
Phila. Elec.	6s	1941	*c*107	106 108½
Phila. Elec.	5s	1966	*c*103½	100 104½
Phila Elec	4s	1966	*c* 85½	83 85½
Phila. Elec	5s	1960	*c*102½	100 104
Phila. Elec.	5½s	1947	*c*106½	103½ 107
Phila. Elec.	5½s	1953	*l*107	104½ 107½
Portland Elec. Pwr.	6s	1947	99	96½ 100½
Portland Gen. Elec.	5s	1935	99½	98½ 100½
Portland Ry., Lt. & Pwr.	5s	1942	88½	84½ 92
Portland Ry., Lt. & Pwr.	6s	1947	99	94 100½
Portland Ry., Lt. & Pwr.	7½s	1946	100½	104½ 108
Potomac Edison	6s	1949	99½	96 100½
Potomac Edison	6½s	1948	103	99 104
Potomac Elec. Pwr	5s	1929	99½	99 100½
Potomac Elec. Pwr	5s	1936	99½	98½ 100½
Power Corp. of N. Y.	6s	1942	101	97 101½
Power Corp. of N. Y.	6½s	1942	104½	101½ 105½
Power Securities	6s	1949	*j* 78	....
Pub. Lt. & Pwr.	5s	1945	69	64 79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92 96
Pub. Serv. Co. of Colo.	6s	1953	98½	98 101
Pub. Serv. Co. of Colo.	7s	1933	101	98½ 102½
Pub. Serv. Corp. of N. J.	5s	1959	104½	103½ 105½
Pub. Serv. Corp. of N. J.	6s	1944	100½	95 100½
Pub. Serv. Co. of No. Ill.	5s	1956	97½	91 98
Pub. Serv. Co. of No. Ill.	5½s	1962	102	96½ 102½
Pub. Serv. Co. of No. Ill.	5½s	1964	102	96½ 102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½ 101
Pub. Serv. Elec. & Gas	5½s	1959	104	98½ 105½
Pub. Serv. Elec. & Gas	5½s	1964	104½	99½ 105
Public Utilities, (Evansville, Ind.)	6s	1929	100	99 101
Puget Sound Pwr	5s	1933	98½	98½ 100½
Puget Sound Pwr. & Lt.	5½s	1949	99½	96½ 100½
Quebec Pwr	6s	1953	102	98½ 102½
Queensborough Gas & Elec	5s	1952	99	96½ 100½
Queensborough Gas & Elec	6s	1953	104½	101 105½
Rhine-Westphalia Electric Power	7s	1950	94	94 95
Rio de Janeiro Tram., Lt. & Pwr	5s	1935	93½	85 94½
Robbins & Myers	7s	1952	62	57½ 73½
Rochester Gas & Elec	5½s	1948	105½	102½ 105½
Rochester Gas & Elec	7s	1946	112½	110 112½
Rochester Ry. & Lt.	5s	1954	100½	99 101½
Rockford Elec.	5s	1939	99½	98 101
St. Joseph Ry., Lt., Ht. & Pwr	5s	1937	91	85½ 93
St. Paul Gas Lt.	5s	1944	100½	98½ 101½
St. Paul Gas Lt.	5½s	1954	101½	98 102½
Salt River Valley Wtr.	6s	1938	*j*100	....
Salmon River Pwr.	5s	1952	100½	98½ 101½
San Antonio Gas & Elec.	5s	1949	96½	96 98½
San Antonio Pub. Serv.	6s	1952	101½	99½ 104
San Diego Cons. Gas & Elec	5s	1939	100	98 101
San Diego Cons. Gas & Elec	6s	1939	101½	99 103
San Joaquin Lt. & Pwr.	5s	1945	98½	98 100
San Joaquin Lt. & Pwr.	6s	1950	102	101 103½
San Joaquin Lt. & Pwr.	6s	1952	101½	99½ 103½
San Joaquin Lt. & Pwr.	6s	1954	100½	99 101½
Sauda Falls	5s	1955	95	95 98½
Savannah Elec. & Pwr.	7½s	1941	*j*104½	....
Saxon Pub. Wks. (Germany)	7s	1945	93	90½ 94½
Scranton Electric	5s	1937	101½	99½ 102½
Seattle Elec		1930	100½	99½ 101
Seattle Elec	5s	1929	99½	99 100½
Seattle Elec	5s	1939	92	90 93½
Seattle Ltg	5s	1949	91½	85½ 93
Shawinigan Wtr. & Pwr.	5s	1934	100½	100 101½
Shawinigan Wtr. & Pwr.	5½s	1950	104	101½ 104½
Shawinigan Wtr. & Pwr.	6s	1950	105	104½ 106½
Siemens & Halske	7s	1928	97	92½ 99½
Siemens & Halske	7s	1935	94½	90½ 96½
Sierra & San Francisco Pwr	5s	1949	76½	75 80
Sierra & San Francisco Pwr	6s	1949	90	87 93½
Sioux City Gas & Elec	6s	1947	101½	99 102½
Sioux City Gas & Elec	6s	1949	101½	99 102½
So. Caro. Gas & Elec	6s	1942	84	87 93
So. Caro. Gas & Elec	6s	1932	75	78 88
Southeast Pwr. & Lt.	6s	2025	90½	88 92
So. Cal. Edison	5s	1939	99½	99 101
So. Cal. Edison	5s	1944	96	92½ 97
So. Cal. Edison	5½s	1944	101	98½ 102
So. Cal. Edison	6s	1943	102½	100½ 104
So. Cal. Edison	6s	1944	104½	102½ 105½
So. Cities Utilities	8s	1931	98	99 102
Southern Colo. Power	6s	1947	*l* 97½	93½ 99½
So. Public Utilities	5s	1943	99½	97½ 100½
So. Sierras Pwr	6s	1936	102½	102 104½
So. Utilities	6s	1933	102	97½ 102½
So. Wisconsin Pwr	5s	1938	91	88 93
Southwestern Gas & Elec	5s	1932	95½	94 98
Southwestern Gas & Elec	6s	1957	97	89 98
Southwestern Lt. & Pwr.	6s	1937	97½	94½ 99
Southwestern Pwr. & Lt.	5s	1948	94	90 97
Southwestern Pwr. & Lt.	6s	2022	92½	88½ 94½
Southwestern Utilities	8s	1936	95	96 102
Springfield Ry. & Lt.	5s	1926	99½	98½ 100½
Standard Elec. of Cal.	5s	1939	98½	98½ 100½
Standard Gas & Elec	6s	1935	99½	91 101
Staten Island Edison	6½s	1953	106	104 107
Syracuse Ltg	5s	1951	100½	97½ 101½
Syracuse Ltg	5½s	1954	103	100½ 103½
Tampa Elec	5s	1933	*j* 99	....
Tenn. Elec. Pwr	6s	1947	103	99½ 104½
Tenn. Pwr	5s	1962	94½	90 96½
Tex. Pwr. & Lt.	5s	1937	98	97 99½
Tex. Pwr. & Lt.	6s	2022	94	90 97½
Tide Water Pwr	6s	1942	99½	98½ 101
Tide Water Pwr	7s	1937	99½	97½ 101½
Toho Elec. Pwr. (Japan)	7s	1955	90½	87 91½
Tokyo Elec. (Japan)	6s	1928	97½	96½ 99½
Toledo Edison	5s	1947	99	97 100
Toledo Edison	7s	1941	109½	108½ 110
Toledo Gas Elec. & Htg.	5s	1935	96½	97 100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	98	97½ 100½
Topeka Edison	5s	1930	99	97 100
Topeka Ry. & Lt.	5s	1933	94½	20½ 96½
Trenton Gas & Elec	5s	1949	99½	9s 100
Tri-City Ry. & Lt.	5s	1930	98½	96½ 99½
Twin State Gas & Elec.	5s	1953	92½	84 94½
Tyrol Hydro-Elec. Pwr.	7½s	1955	96½	94½ 97
Union Elec. Lt. & Pwr.	5s	1932	100½	99½ 102
Union Elec. Lt. & Pwr.	5s	1933	100½	98½ 101
Union Elec. Lt. & Pwr.	5s	1954	99	97½ 100
Union Elec. Lt. & Pwr.	5½s	1954	101½	100 104
United Elec. of N. J.	4s	1949	87½	85 89
United Elec. Lt. & Pwr.	4½s	1929	98	96 100
United Gas & Elec	6s	1945	100	96 101
United Lt. & Pwr. notes	5½s	1928	99½	98 100
United Lt. & Pwr.	5½s	1959	94½	90½ 97½
United Lt. & Pwr.	6½s	1974	95½	92½ 97½
United Lt. & Rys.	5s	1932	95½	92½ 97½
United Lt. & Rys.	6s	1926	99½	100½ 101½
United Lt. & Rys.	6s	1952	98	95½ 100½
United Lt. & Rys.	6s	1973	89	87 92
United Pwr. & Lt.	6s	1944	101½	99 103
Utah Lt. & Trac.	5s	1944	87½	83½ 91½
Utah Pwr. & Lt.	5s	1944	95½	91 98½
Utah Pwr. & Lt.	6s	1944	103	102 104½
Utah Pwr. & Lt.	6s	2022	92½	88½ 94½
Utica Elec. Lt. & Pwr.	5s	1950	100½	100½ 102½
Utica Gas & Elec.	5s	1957	100½	98½ 103
Vermont Hydro-Elec.	6s	1929	100	98½ 100½
Vicksburg Lt. & Trac.	5s	1932	91	89 93½
Virginian Pwr	5s	1942	93	88 96
Virginian Pwr	6½s	1954	102½	99 103½
Virginia Ry. & Pwr.	5s	1943	98½	93½ 99
Wagner Elec. Mfg.	7s	....	*l*101½	100 102
Washington Coast Util.	6s	1941	101½	99½ 102
Washington Wtr. Pwr.	5s	1939	101½	99½ 101½
West Penn Pwr	5s	1963	100	93½ 100½
West Penn Pwr	5s	1946	100	93½ 100½
West Penn Pwr	5½s	1953	104½	100 106½
West Penn Pwr	7s	1946	106	104½ 107½
West Virginia Lt., Ht. & Pwr	6s	1929	102	95 101½
West Virginia Utilities	6s	1935	95½	91 98
Westchester Ltg	5s	1950	102	98 102½
Western Elec	5s	1944	100½	98 101½
Western N. Y. Utilities	5s	1946	96½	90½ 97½
Western Pwr	6½s	1954	100½	97 101½
West. States Gas & Elec.	5s	1941	98	95 99½
West. States Gas & Elec.	6s	1947	99	97 100½
Westinghouse Elec. & Mfg.	7s	1931	105½	105½ 108½
Westphalia Un. Elec. Pr.	6½s	1950	*l* 87½	87½ 87½
Wisconsin Elec. Pwr.	5s	1964	98½	93½ 99½
Wisconsin Gas & Elec.	5s	1952	99	97 100½
Wis.-Minn. Lt. & Pwr.	5s	1944	95½	93 96½
Wis. Ry., Lt. & Pwr.	5s	1933	92½	87½ 93½
Wis. River Pwr.	5s	1941	91	88 92½
Yadkin River Pwr.	5s	1941	98½	96½ 99½
Yarmouth Lt. & Pwr.	5s	1937	83	82 87
Yarmouth Lt. & Pwr.	8s	1951	98	97 102

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh, *j*Bid, low, high, Tuesday, Jan. 12. *k*Bid, low, high, Wednesday, Jan. 13. *l*Latest quotations available. *m*1926.

Manufacturing and Markets

Encouraging Prospects for Industry in Canada

Commenting upon the progress of the electrical industry in Canada during 1925 and the prospects for the present year, D. C. Durland, president of the Canadian General Electric Company, Ltd., said: "Hydro-electric developments last year gave the electrical manufacturers a considerable volume of large apparatus orders, and the prospective new power plants and additions to existing installations to be constructed this year are encouraging. The distribution of electric current from these plants into factories, residences and other buildings is providing an increasing scale of small electrical machines and devices. The establishment of new manufacturing enterprises, such as the great factories of the Aluminum company being built on the Saguenay River in Quebec and the new or enlarged pulp and paper mills, are providing a market for electrical equipment. New inventions and the exploitation of new electrical appliances, such as radio equipment, are also contributing to the expansion of the electrical industry. The volume of business booked last year shows a moderate increase over 1924," said Mr. Durland, "and the greater sale of incandescent lamps and small electrical devices reflects improvement in the consumption of electrical products and the increasing uses of electricity."

Refrigerators Made in 1926 to Use 30,000,000 Lb. of Copper

Manufacture of electric refrigerators for general use has reached an importance which makes it one of the largest of the newer uses of copper, according to a survey just completed by the Copper and Brass Research Association. It is estimated that iceless refrigeration units which will be manufactured in 1926 will require almost 30,000,000 lb. of copper. Expanded development of the industry which produces apparatus for this type of refrigeration has been very rapid in the past year through the linking up of co-operative effort between the manufacturers and the electric power companies. Motor windings and parts, switches, wiring, etc., are of copper, as are also compressor parts, tubing, tanks, etc. In ice-cream boxes large amounts of sheet copper are also used for tanks and tank covers.

The tremendous increase in the domestic refrigeration field is shown in the following figures for machines sold:

1919	3,000	1923	16,000
1920	5,000	1924	17,500
1921	7,000	1925*	52,500
1922	11,000		

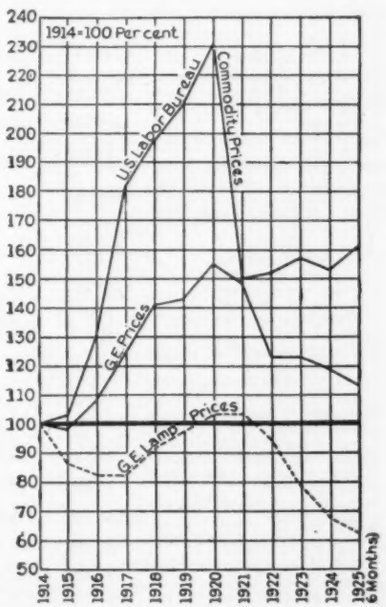
*Estimated.

A few years years ago there were less than six companies manufacturing household electric refrigerators, while today there are more than thirty-four manufacturers and the number is growing rapidly. There are 14,532,930 homes in the United States now wired for electricity, and homes are being equipped with electric service at the rate of 1,500,000 to 1,750,000 per year. The number of washing machines in use now is about 4,300,000, and the number of domestic refrigerators should soon reach that total. The possibilities for this growing industry can thus be seen to be enormous.

General Electric's Position

Statement Defines Company's Relation to Electrical Industry in Answer to Allegations Made in Congress and Now Under Investigation by Trade Commission

IN THE quarterly statement to the stockholders of the company Gerard Swope, president of the General Electric Company, covers the subject of "General Electric's Position in the Electrical Industry." This statement is an answer to the charges of unlawful monopoly made in Congress and referred for investigation by that body to the Federal Trade Commission. The company has replied in full to all such charges made against it and definitely states the connections of the company with other electrical manufacturers, power companies and financial interests.



COMPARISON OF U. S. LABOR BUREAU COMMODITY PRICES AND GENERAL ELECTRIC PRICES FROM 1914 TO 1925

In the statement the company explains its relations with the Alabama Power Company and its connection where such exists with water power, the light and power business, the Electric Bond & Share Company, the Westinghouse company and the Western Electric Company. The company also defines its position as a manufacturer and says that it is the largest manufacturer in the electrical industry. Taking 1923 for comparison, because the figures for that year are the latest census figures, the output of manufactured products of the company was approximately $271,310,000 and the number of wage earners employed was 58,762. In accordance with the census, these are respectively 21 per cent of the total output of electrical manufacturers and 25 per cent of the wage earners employed in the electrical manufacturing industry in the United States.

In accordance with the figures of the American Bureau of Metal Statistics, the company says that in the five years 1920-1924 inclusive it used an average of 20 per cent—not more than 22.2 per cent in any one year—of the copper used in the electrical manufacturing industry. The company also points out that its capitalization is only 22 per cent of the total, based on a chart showing the capitalization of electrical manufacturing companies that appeared in the Sept. 20 issue of the ELECTRICAL WORLD.

A chart included in the statement to the stockholders and shown here compares the General Electric selling prices with the curve of commodity prices compiled by the United States Bureau of Labor Statistics. Taking prices in 1914 as 100 per cent, the chart shows that in 1920 commodity prices rose to 231 per cent, while the company's prices rose to 155 per cent. During the first six months of 1925 the commodity prices were 161 per cent, the company prices were 113 per cent and its lamp prices were 62 per cent of the prices in 1914.

The company in answering the statement that it is controlled by J. P. Morgan & Company says that slightly over 1 per cent of the voting stock stands in the names of J. P. Morgan & Company or its nominees, Morgan & Company asserting that ownership of this stock is divided among numerous clients. Two of the twenty directors of the company are members of the Morgan firm. The company also points out that there has been no violation of the decree of the federal court entered in 1911. This matter has been thoroughly investigated by the company's counsel,

who advise it that there has been a complete compliance not only with the letter but also with the spirit of this decree. Reference is also made to the suit brought in 1924 against the company's lamp business, when the decision of the federal court in Cleveland was in its favor.

Meeting of N.E.C. Committee on Article 5

The National Electrical Code committee on Article 5, at the request of interested parties, will hold a hearing on Monday, Jan. 25, 1926, at 10 a.m. in the auditorium of the Chicago Board of Fire Underwriters, twenty-first floor, Insurance Exchange Building, Chicago. At the hearing opportunity will be provided for all parties interested in the proposed rules on non-metallic sheathed cables to be heard by the committee, provided letter briefs are filed with A. Penn Denton, chairman, 512 Southwest Boulevard, Kansas City, Mo. in advance. Owing to limited time those failing to file such briefs will not be heard. Information obtained at the hearing will be submitted to the electrical committee at its forthcoming annual meeting.

Outlook Promising, Says Gerard Swope

"I think the outlook for the electrical equipment industry in 1926 is promising," said Gerard Swope, president of the General Electric Company, in commenting on the business conditions for 1926. "A large demand for electrical machinery comes from manufacturing establishments. The conversion of factories to the use of electric power is not yet complete as out of 33,000,000 hp. used in factories throughout the United States, only 67 per cent is electrical. New applications of electric motors, providing increased power back of the worker, are still further enlarging their field of use.

"New electrical devices in the home as well as more adequate lighting are improvements constantly going on which also enlarge the field for the electrical equipment industry. The electrification of steam railroads is under consideration and especially the use of oil-electric locomotives for branch lines and switching operations. The year 1926, therefore, while it does not promise to be a boom year, will continue the orderly development which is much healthier for the industry."

Business Conditions

SALES in the industry are in good volume and electrical men are optimistic as to continued and even better business during the first quarter of the year. Many requests for quotations continue to be received. The General Electric Company has just announced that its orders for 1925 amounted to $302,513,380. This compares with $283,107,697 for 1924, an increase of 7 per cent. A large manufacturer of wire and several small manufacturers of motors have also reported a good increase in sales during 1925 as compared with the previous year. The United States Steel Corporation has reported its unfilled orders on Dec. 31, 1925, as amounting to 5,033,364 tons, the largest since the close of February last year. There was a gain of 451,584 tons for December. This gain is larger than was expected and is believed to be largely owing to the curtailment of shipments during the holidays.

Export sales of electrical apparatus are showing an even better increase than domestic business. The increase is estimated at better than 15 per cent. Japan has been a large buyer, an order for more than $500,000 having been entered in December, and many extensions to central-station systems in that country are planned. Europe is gradually getting into shape, orders having been placed by Italy for electric railway motors last month. Some interesting purchases were also made by Russia. South America offers many possibilities this year, particularly for industrial expansion. Merchandise sales are active in the Argentine, and conditions are good except for the present Mexican situation and the possibility of new labor laws in Chile which may react unfavorably.

In New England equipment trade has been less active, but prospects are good, the demand for construction supplies is heavy, and the extension of power lines and the wider utilization of power are subjects of increasing interest. A power contract closed in that district covered a load of 12,000 kw. Industrial buying continues in good volume in the New York district and consists of many small orders, although some large ones are in prospect. Central-station companies in the New York district are also making many inquiries, some of which are evidently for estimating purposes, and the market is considered quite active. In the Southeast no large single orders are reported, but an extraordinary number of quotations are being made, particularly from industrial plants that contemplate immediate expansion. The outlook for business continues good in the Middle West, industrial activity is quite noticeable, and the various utility

Value of Electrical Exports for November, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	November 1924	November 1925
Generators:		
Direct-current:		
Under 500 kw.	$59,658	$67,606
500 kw. and over	23,060	81,496
Alternating-current:		
Under 2,000 kva.	8,750	7,835
2,000 kva. and over	44,000	282,346
Steam-turbo generator sets	586	9,397
Accessories and parts for generators	148,132	160,728
Self-contained lighting outfits	38,309	121,293
Batteries:		
Flashlight batteries	91,521	76,916
Other primary batteries	87,798	100,646
Storage batteries	216,811	181,002
Transforming or converting apparatus:		
Power transformers	112,540	67,354
Other transformers	143,427	104,994
Rectifiers, double-current and motor generators, dynamotors, sychronous and other converters	137,277	43,931
Transmission and distribution apparatus:		
Switchboard panels, except telephone	238,390	264,571
Switches and circuit breakers over 10 amp	225,589	174,139
Fuses and fuse blocks	22,247	29,502
Watt-hour and other measuring meters	34,977	51,576
Volt, watt and ampere meters and other recording, indicating and testing apparatus	128,623	118,327
Lightning arresters, choke coils, reactors and other protective devices	45,470	35,593
Motors, starters and controllers:		
Motors, under 1 hp.	133,869	136,329
Stationary motors:		
1 to 200 hp.	137,501	269,882
Over 200 hp.	29,141	73,216
Railway motors	94,230	57,186
Electric locomotives:		
Railway	.....	185,100
Mining and industrial	1,440	19,955
Starting and controlling equipment for:		
Industrial motors	62,405	98,678
Electric railway and vehicle motors	1,193	8,455
Accessories and parts for motors	201,458	134,128
Electric fans	21,268	32,261
Electric lamps:		
Metal-filament	80,041	92,007
Other electric lamps	28,986	17,952
Flashlights	63,424	95,635
Searchlights and projectors	$13,138	$51,410
Motor-driven household devices	83,105	90,060
Domestic heating and cooking devices	100,783	109,879
Industrial electric furnaces and ovens	23,487	32,269
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	101,686	116,018
Signal and communication devices:		
Radio apparatus	948,993	1,277,060
Telegraph apparatus	53,739	41,368
Telephone apparatus:		
Magneto telephones	18,429	11,719
Other telephones	30,262	37,851
Telephone switchboards	12,711	5,020
Other telephone equipment	155,551	142,367
Railway signals, switches and attachments	63,625	51,145
Bells, buzzers, annunciators and alarms	12,606	12,712
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	125,279	210,075
Insulating material	87,543	89,881
Metal conduit, outlet and switch boxes	32,036	83,486
Sockets, receptacles and lighting switches	105,348	138,302
Electric lighting switches, interior and street	77,585	154,289
Other wiring supplies and line materials	76,467	169,081
Other electrical apparatus	565,676	563,993
Globes and shades for lighting fixtures	41,368	37,834
Electrical glassware except for lighting	24,589	13,253
Electrical porcelain	84,450	†
Electrical porcelain for less than 6,600 volts	*	102,257
For 6,600 volts and over	*	25,282
Carbons, carbon brushes and electrodes	388,390	†
Electrodes for electric furnaces	*	174,784
Other carbon products	*	81,567
Insulated wire and cable (iron and steel)	20,676	28,538
Other manufactures of aluminum	52,323	67,661
Copper, bare wire	110,706	93,438
Copper, insulated wire and cables	298,612	638,332
Total electrical machinery and apparatus and supplies	$6,371,284	$7,860,967

*Not separately stated prior to January 1, 1925.
†Discontinued beginning January 1, 1925.

companies are planning for greater expansion. On the Pacific Coast motor sales are excellent, particularly as regards pumping-plant sizes. Sales of heavy machinery are quiet, but general power company purchasing is good.

Copper Prices Stiffen—Metals in Moderate Demand

OF THE non-ferrous metals, lead has been in most active demand during the week, but sales of copper and zinc cannot be called dull. Prices have shown little change though copper is fractionally higher and zinc somewhat easier. Though tempted by offers from prominent buyers to take large tonnages at concessions from 14¼ cents, delivered, copper sellers apparently are holding firm at that price for deliveries at normal freight rate points. Good-sized tonnages have brought 14¼ cents, delivered, in the Middle West, and, on the other hand, some sales were made at 14 cents and 14.05 cents last week. Producers believe that the large purchases of February metal are yet to be made and are waiting for buyers to meet their price. The London market has apparently improved.

The substantial business transacted in lead has been mostly for February

NEW YORK METAL MARKET PRICES

	Jan. 6, 1926 Cents per Pound	Jan. 13, 1926 Cents per Pound
Copper, electrolytic	14⅛	14.15
Lead, Am. S. & R. price	9¼	9¼
Antimony	23¾–25	24¾
Nickel, ingot	35	35
Zinc, spot	8.75–9.05	8.85
Tin, Straits	63¼	63
Aluminum, 99 per cent	28	28

Base copper price Jan. 13, 1926, 16 cents

shipment at practically the same prices as those of the succeeding week. January lead is scarce and premiums are generally quoted for immediate shipment, but consumers seem well supplied for their current requirements and the tonnage sold at the premium prices is insignificant. The American Smelting & Refining Company continues its contract price of 9¼ cents and has sold freely at that level except for January shipment. The London market shows signs of strengthening. Lead prices in the domestic market are apparently fairly well stabilized for the time being at the recent levels. The consensus of opinion seems to be that the lead market is likely to remain as it is or advance moderately in the near future, but opinions as to the course of the market from early summer on are rather bearish.

The figures of the American Zinc Institute, showing an increase in stocks of 2,773 tons during December, have apparently eased buyers' minds somewhat, and the current price reflects this feeling. Some buying by dealers who were short of January zinc was recorded at 8¾ cents for prompt shipment, but the volume of this business has been small. Tin prices are down slightly from last week, a fact which stimulated a little business particularly on Thursday of last week, when the good demand made the market exceedingly strong at the close. The market for spot tin has varied between 62 cents and 63 cents all week.

Equipment Trade in New England Less Active—Prospects Good

ORDERS for industrial equipment and supplies have fallen off in the New England district, but, on the other hand, certain commodities, such as conduit, wire and wiring devices, have been very active. Much construction is under way, and enough new contracts were closed to indicate that continued activity can be expected for the next three months. With the labor conditions satisfactory, and an open winter well along, the demand for construction supplies will be unusually heavy. Several large developments in residences are projected. In the Cape Cod district much activity in new construction is reported and many watt-hour meters for residence service are scheduled for purchase. Electric refrigeration is quite active but, for the most part, is reported confined to apartment-house installations, with one prominent company engaged in completing sixty such units. Oil-burning apparatus has been attracting increased attention, and manufacturers are busy with negotiations and quotations, a number of recent installations being reported. The demand for this type of equipment is mainly for use in the larger types of buildings.

Household appliance sales are showing encouraging gains, one group consisting of fourteen central-station companies showing a gain of more than 25 per cent for the first week of 1926 as compared with last year. Salesmen reporting from outside surveys record an active trend in buying, due to a decided betterment in industrial centers and a marked confidence in the prospects for the coming year. Extension of power lines and wider utilization of power are subjects of increasing interest in this district. A large power contract, covering a load of 12,000 kw., has been closed by the Blackstone Valley Gas & Electric Company with the J. & P. Coates Company, Pawtucket, R. I.

Number of Inquiries Requested in Southeast Presage Activity

NO LARGE single orders are reported in the Southeast, but inquiries are being received in large numbers and an extraordinary number of quotations are being made by local jobbers on goods for shipment at dates in the near future. The outstanding feature of these inquiries is the satisfactory number from industrial plants contemplating immediate expansion and from proposed new commercial establishments. Central-station inquiries on construction materials are very good, and indications point to activity in distribution and transmission line materials in the near future. The Georgia Railway & Power Company has recently placed orders for a large portion of the material for the 18-mile, steel-pole line extension from Marietta to Douglasville to serve the recently purchased municipally owned distribution system at Douglasville and the industries in that vicinity.

A number of small-sized orders for construction materials were received this week, but sales of appliances are very quiet, except in those localities where campaigns are soon to be undertaken. In these instances orders for flatirons and percolators are being placed in satisfactory volume. Electrical contractors report no large contracts closed since the holidays, but the volume of smaller industrial jobs in hand is satisfactory and the outlook for increased activities within the next few weeks is bright.

Volume of Sales Up in New York District—Industry Active

THE volume of sales is holding up well in the New York district and many inquiries are being received in the market. Requests made by central-station companies for quotations for estimating purposes presage active buying from that source. Large industrial orders in prospect indicate that sales during the latter part of this month will be heavy. One order that will shortly be placed will call for about $11,000 worth of motors. The demand for material for central-station properties in the South remains active. Manufacturers state that wire sales show no sign of a let-up, and indications are that the present volume will continue.

Jobbers report that general buying is diversified and the volume of sales is encouraging. Prices are much firmer, there being less tendency to cut prices except in one or two lines. The demand for electric refrigerators is active and central-station companies are planning to meet the growing business this spring and summer. Quotations are now being made on electric trucks to be used for delivering refrigerators.

Motor Sales Good on Pacific Coast—Lumber Mills Active

MOTOR sales are excellent on the Pacific Coast, particularly as regards pumping-plant sizes, but sales of heavy machinery are quiet. The only disturbing business factor now is the lack of rain and an unusually prolonged cold spell which may repeat the disappointing year of 1924. Power company purchasing is very good and includes orders and inquiries for 1,200 assorted cross-arms, sizes 3½ in.x4½ in. in lengths of from 6 ft. to 13 ft.; four carloads of poles, three carloads of four-way clay conduit, 25,000 1½ in. x 9 in. locust pins, many orders of from 5,000 to 15,000 pieces of pole-line hardware, as well as orders for standard supplies in larger than average orders, such as 108 spoons and shovels and ten barrels of strain insulators. Hawaiian business is good, a bumper pineapple crop having offset the poorer market for sugar. Among recent Hawaiian orders is one for 100,000 ft. of fiber conduit and 90,000 ft. of assorted sizes of telephone wire.

Railroad buying is good, though not heavy. A recent order covered one carload of assorted $\frac{7}{16}$-in. high strength and $\frac{3}{8}$-in. Siemens-Martin strand. Contractors' business is very good, the number of sizable orders for miscellaneous stock items showing that stocks were allowed to run very low. The smaller-town dealers are exceptionally well represented. Rubber-covered wire, flexible metallic conduit and schedule wiring material predominate in the orders. Business from industrial plants is also very good, especially

from coast firms manufacturing electrical devices. Recent orders from such firms have included $1,500 worth of cut-outs, 80,000 ft. of meter cord, 200 steam-tight lighting units and $1,000 worth of receptacles and push switches, all for incorporation in manufactured products. Lumber mills have started buying motors for replacements and additions. Competition is keen and much price cutting, somewhat augmented by used machinery dealers, is in evidence.

Outlook for Business Continues Good in Middle West

EARLY indications do not change the previous outlook for business in the Middle West. There is a feeling of confidence among most manufacturers, industrial activity is quite noticeable, and the various utility companies are planning for greater expansion. Among the interesting orders placed this week were the following: 123 current-limiting reactors, 790 direct-current watt-hours meters, 5 amp. to 150 amp.; 3,000 watt-hour meters, 5 amp.; and 94 current transformers, 10 amp. to 1,500 amp. There has been a good demand for insulators, pole-line hardware, poles and cables.

Jobbers' sales accelerated somewhat following the inventory-taking period. It appears that more radio equipment is being sold this month than last. There has been a good demand for conduit, wire and wiring devices. There is also a good demand for almost all classes of electrical appliances. Industrial-heating sales are increasing, sales of lighting fixtures to various outlying stores are good, and the prospects in both of these fields of endeavor look very promising for 1926.

Activities of the Trade

Lighting Equipment Association Moves Headquarters to N. Y.

The National Association of Lighting Equipment Dealers has announced the removal of its headquarters to 522 Fifth Avenue, New York. The association states that this move was made so that the organization could render a more valuable service to its members. In its new quarters, which are in the same building as the offices of the Society for Electrical Development, the association states that it will have at its disposal the experiences of the society, certain specialized assistance of the members of the staff, publicity channels and better contact with leaders and business executives throughout the electrical industry.

General Electric Orders for 1925 Increase 7 per Cent

Orders received by the General Electric Company for the year ended Dec. 31, 1925, amounted to $302,513,380, according to an announcement by Gerard Swope, president of the company. Compared with $283,107,697 for the year 1924, this was an increase of 7 per cent. For the three months ended Dec. 31, 1925, orders totaled $78,636,669, which compares with $80,009,978 for the same quarter of 1924, a decrease of 2 per cent.

Cowan and Stuebing Truck Companies Announce Merger

The Stuebing Truck Company, Cincinnati, and the Cowan Truck Company, Holyoke, Mass., manufacturers of lift trucks and platforms under their respective names since 1912, have announced a merger. The name of the new corporation is the Stuebing-Cowan Company. The products of the two companies, it is said, will now represent a complete line of equipment.

The directing headquarters of the Stuebing-Cowan Company will be at Cincinnati, but the Cowan truck division will continue its operations at Holyoke. The merger represents a combination of assets and resources of approximately $1,000,000. The company states that sales offices will be maintained in all of the principal cities with stocks located at convenient points.

Westinghouse Announces Order for Converter and Switches

An order for a large frequency changer, weighing more than 600 tons, has been placed by the Philadelphia Electric Company with the Westinghouse Electric & Manufacturing Company. The unit will be installed in the Schuylkill River station of the Philadelphia Electric Company. It will be 55 ft. long and 22 ft. high, and the motor will have a capacity of 60,000 hp. at 100 per cent power factor. The contract covering the above equipment also includes eight 73,000-volt oil circuit breakers with a rupturing capacity of 1,500,000 kva. The total amount of the contract aggregates nearly $750,000.

New Course in Illumination Design and Sales Methods

The Edison Lamp Works of the General Electric Company, Harrison, N. J., will hold its third midwinter course in illumination design and sales methods at the Edison Lighting Institute, Harrison, N. J., from Feb. 15 to 20. This course is planned primarily for sales and service men of electric service companies. Those who attend will receive a thorough background in illuminating engineering and its application, which will include lectures on special methods found successful in selling lighting installations.

The course of instruction offers to electric service companies an opportunity for training men in illuminating engineering, present lighting practice and the commercial aspects of the lamp business. All communications regarding reservations, details of the conference, etc., should be addressed to T. F. Joyce.

International G. E. Sells Large Turbines in Buenos Aires

The Compañia Hispano-Americana de Electricidad has placed an order with the International General Electric Company for two 52,500-kw. tandem-compound, steam-turbine generators as the initial installation for the new generating station to be built at the entrance to the harbor of Buenos Aires.

Each complete unit will consist of a 50,000-kw., 13,200-volt, 1,500-r.p.m. main unit with a 250-volt direct-current exciter, and a 2,500-kw., 2,300-volt service generator with its own direct-current exciter, all mounted on the same shaft. The turbines will operate at an initial steam pressure of 550 lb. gage and 750 deg. F. total temperature, with full intermediate heat of the steam between the cylinders.

Representatives' Association Formed in Baltimore

The Electrical Manufacturers' Representatives' Association of Baltimore was formed on Jan. 4 last and has adopted the trade name EMRA. The officers elected are. J. Harry Gross, National Metal Molding Company, president; J. B. Mitchell, Economy Fuse & Manufacturing Company, secretary, and William Pindell, Holtzer-Cabot Company, treasurer.

This organization is said to be the result of a desire on the part of the manufacturers' representatives for a better mutual understanding and in order to effect a cohesive group consisting of those desirous of rendering a larger measure of service to the electrical distributor and contractor, as well as to the public. The organization will also act as a medium for the discussion of problems with a common interest. Membership will be open to all electrical manufacturers' representatives and sales agents whose business methods and sales policies are such as to make for the good of the industry and general public.

The Polaris Electrical Refrigeration Company, Logansport, Ind., now being organized by local interests, has acquired the former Logansport plant of the Revere Automobile Company, which has been inactive for several years past. The new company will remodel and convert the structure for the manufacture of electric refrigerators and refrigerating apparatus.

The G. K. McMullen Company, 201 McMullen Building, Grand Rapids, Mich., announces the opening of its office as direct factory representative for wood and metal working machinery, electric motors, air compressors and specialties. The territory will cover western, central and northern Michigan.

The Simplex Wire & Cable Company, Boston, announces the opening of a branch office in the Union Trust Building, Euclid Avenue at East Ninth Street, Cleveland, in charge of William H. LaMond.

The Earle Gear & Machine Company, 4707 Stenton Avenue, Philadelphia, engineers and machinists, announces the sale and transfer of all designs, patterns, patents and good will covering Earle centrifugal pumps to the Al-

drich Pump Company, 1 Pine Street, Allentown, Pa., who will continue the manufacture and marketing of same. The Earle company states that this will not interfere with its regular business of manufacturing Earle cut gears and other products.

The Boiler Engineering Company, 760 Broad Street, Newark, N. J., announces that J. W. Putnam is now associated with the company as general manager. The company states that it has placed on the market the "Beco" baffle, which is covered by a patent recently issued to Mr. Putnam. Mr. Putnam has severed his connection with the Engineer Company, New York, as manager of the baffle-wall department. The Engineer Company has retained the exclusive right to sell and install "Turner" baffles.

The H. B. Sherman Manufacturing Company, Battle Creek, Mich., manufacturer of brass goods, announces that its program of expansion extending over many months has culminated in the completion of extensive new buildings and a complete rearrangement and remodeling of the entire plant. The company states that its production possibilities have increased nearly 100 per cent.

The Westinghouse Electric & Manufacturing Company has placed on the market a fan known as the "Rotaire," which is mounted at a 45-deg. angle on a hanger and is so geared that the fan rotates completely around the hanger.

The Crouse-Hinds Company, Syracuse, N. Y., manufacturer of conduit fittings and electrical specialties, is having plans prepared for a two-story factory addition.

The Mutual Electric & Machine Company, Detroit, manufacturer of "Bull Dog" safety switches, etc., announces the addition of the type AF to its line of "Fusenters," a fused cabinet recently placed on the market by that company and described in the Sept. 26 issue of the ELECTRICAL WORLD. The type AF is made in all sizes and arrangements.

The Electric Storage Battery Company, Philadelphia, announces a change of location of its Boston branch to 100 Ashford Street, where larger quarters have been established.

The Van Rosen Company, Boston, announces the removal of its offices to 141 Milk Street, where the company will continue as manufacturers' representative for the Delta-Star Electric Company, the Bates Expanded Steel Truss Company, the W. N. Matthews Corporation and the Packard Electric Company.

The Black & Decker Manufacturing Company, Towson, Md., manufacturer of electric drills and grinders, has awarded a contract for the erection of a one-story addition to its plant, 100 ft. x 200 ft.

The Columbus Handle & Tool Corporation, Columbus, Ind., announces the establishment of the following agencies for distributing its "Stud-E" linemen's construction tools and handles: The Joslyn Manufacturing & Supply Company, Chicago, North Kansas City, Mo., and Cincinnati; the American Jobbers' Supply Company, New York City, Philadelphia and Boston; the Southern Jobbers' Supply Company, New Orleans; the Jobbers' Supply Company, St. Paul, Seattle and Portland, and the Baker-Joslyn Company, San Francisco and Los Angeles.

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, announces that the Paul G. Bentley Company of Houston, Tex., has been appointed agent for Texas, Oklahoma and western Louisiana.

The Pennsylvania Crusher Company, Philadelphia, manufacturer of coal-crushing equipment, etc., announces the removal of its offices, since Jan. 1, to the Liberty Trust Building, Broad and Arch Streets.

New Equipment Available

Induction Arc Welder

The Owen alternating-current induction arc welder, so constructed as to produce a constant steady welding arc by induction, has been placed on the market by the Greensboro Supply Company, Greensboro, N. C., as sole distributor. A wide range of taps are brought out of the case for use as required. By closing a knife switch on the desired tap it is brought into use. It is said that the machine will weld cast and malleable iron the same as steel. The Owen welding, it is said, will take care of the heaviest jobs necessary at a current consumption of less than 4½ kw. demand.

Entrance Switch

A 30-amp., 125-volt, two-pole plug-fuse, class "B" type of entrance switch, listed as type No. 33, has been placed on the market by the Wadsworth Electric Manufacturing Company, Covington, Ky. The switch is made in four combinations and is an addition to the company's present complete line of meter-service and entrance switches, being produced to meet the demand for a small compact switch and at the same time allow ample wiring space.

Laboratory Electric Furnaces

To meet the increased demands of technical schools, research laboratories and industrial plants for small melting furnaces, the Pittsburgh Electric Furnace Corporation, Thirty-second Street and Allegheny River, Pittsburgh, has designed several types of "Junior 'Lectromelt" furnaces, these being duplicates on a smaller scale of the larger "'Lectromelt" furnaces. These furnaces are also used for making small, special-analysis heats in regular production. The largest of these furnaces is the 250-lb.-per-hour, three-phase, direct-arc unit. This furnace is usually operated at about 500-lb. heats, but it is said can handle heats of from 700 lb. to 800 lb. without excessive overload.

Next in size is the 125-lb.-per-hour furnace, which is rated at 125 lb. of acid steel per hour, but is usually operated at about 250-lb. heats and will hold 300 lb. if necessary. The furnace superstructure and roof refractories of this unit are so designed that the furnace can be operated on either direct or indirect arc as desired. For hand control of the heat input the electrodes of this furnace are moved by small micrometer cranks. On automatic control winch motors regulate the arcs. This furnace is usually operated on a 220-volt, single-phase, 60-cycle, alternating-current power supply. The smallest furnace made is known as the ladle or crucible type furnace and has a capacity of 50 lb. This furnace is operated on a 110-volt, 60-cycle, single-phase power supply.

Flow Indicator

A no-flow alarm attachment for the "H-J-M" flow indicator described in the Sept. 26 issue of the ELECTRICAL WORLD has been developed by Hansen, Jones & Morey, 910 West Sixth Street, Los Angeles, Cal. The device will cause an alarm bell to be sounded in case the flow of liquid ceases in the transformer cooling system or other apparatus. A small heater coil may be attached to the bottom of the indicator body so that the instrument may be used in zero or below-zero weather.

Watertight, Acid-Resisting Remote-Control Station

A water-tight, acid-resisting remote-control station has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. The mechanism is inclosed in a cast-iron case and has a cover fitted with a gasket, which excludes all moisture and fumes. A stuffing gland, fitted to the shaft, provides a tight fit, and the thick wall of the cast-iron body allows enough threads for a tight conduit or pipe connection. Contact is made on the brass cylinder by two heavy fingers, which are mounted on asbestos lumber and are zinc-plated, as are all other small parts. The contact tips are of heavy-bar-rolled copper. The fingers are of sufficient capacity to permit the use of this master control station on any pilot circuit at all commercial voltages. The case of this remote-control station is sprayed with a protecting paint to withstand submersion in water or the effect of acid fumes.

Rail-Bond Tester

The type BBT portable direct-reading rail-bond tester for applications where the current in the rail is completely feeble or where such current is absent, as on new construction or at the ends of trolley lines where no cars are running beyond the point at which tests are being made, has been developed by the Roller-Smith Company, 233 Broadway, New York. This tester is said to be extremely sensitive and can be used with the current from a No. 6 dry cell.

New Trade Literature

FURNACE GRATES. — Catalog GG-3 issued by the Combustion Engineering Corporation, Combustion Engineering Building, Broad Street, New York City, describes the "Grieve" grates for burning coal under hand-fired boilers. It contains illustrations showing the grates in different positions, drawings of various types of the grate and a list of representative installations.

TRANSFORMER LOAD INDICATOR.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-309 covering the "G-E Thermotel" transformer load indicator for pole or subway service. Instructions are given for the installation and operation of the "Thermotel." A drawing showing the "Thermotel" mechanism is included.

ELECTRIC TIME SWITCHES. — The States Company, Hartford, Conn., is distributing section 8 of catalog No. 4 describing various types of the States electric time switches for use in street-lighting systems, automatic substations, electrically driven refrigerating plants, show-window lighting, etc. It contains illustrations showing both exterior and interior views of the type "Z" motor-driven time switch with type "CAH" astronomic dial. Attention is also called to the States temperature-regulating apparatus.

TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, is distributing a leaflet covering its type K-1, K-2 and K-3 dry type current transformers for accurate metering on 4,500, 7,500 and 15,000 volts, 25 and 60 cycles. Curves are given showing the phase angle and ratio errors on all three types.

UNIT PULVERIZING SYSTEM.—"The Riley Atritor Unit Pulverized Coal System" is the title of a bulletin issued by the Riley Stoker Corporation, 9 Neponset Street, Worcester, Mass., which describes the Riley "Atritor," a unit pulverizing system that takes raw coal from the bunker, pulverizes it to a uniform fineness with low power consumption and burns the pulverized coal at continuous high efficiency. Illustrations are given showing the course of the coal from raw-coal bunker to burner, with a curve which shows the actual power input to the "Atritor" over a wide load range as determined by carefully conducted tests.

BOILER-ROOM OPERATION. — The Republic Flow Meters Company, 2,240 Diversey Parkway, Chicago, has issued Article VII, entitled "Results from the Owner's Point of View," which is one of a series on boiler-room operation in which it gives results achieved in practice in small industrial plants from the owner's point of view.

CONTROLLING RHEOSTATS.—Bulletin No. 410 issued by the Allen-Bradley Company, Milwaukee, describes and illustrates its types "E-2, 100" and "E-2, 200" controlling rheostats for testing and experimental work and as battery-charging rheostats in battery-manufacturing plants, electric vehicle garages, ignition battery service stations and broadcasting stations. They are also used in both school and industrial laboratories where fine control is essential.

ELECTRIC FANS.—The Western Electric Company, 100 East Forty-second Street, New York City, is distributing the 1926 Western Electric fan manual, with the complete set of selling helps offered. It contains illustrations of various window-display designs, folders covering the use of fans in the house, office, etc.

POLYPHASE INDUCTION MOTORS.—The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing bulletin No. 1118-D covering its polyphase induction motors, types "AR" and "ARY." This is a revised edition of a previous bulletin on this subject.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Koenigsberg, Germany (No. 18,680), for electrical massage apparatus, hair-cutting machines, manicure apparatus, and vacuum cleaners.

Purchase is desired in Johannesburg, South Africa (No. 18,655), of electrical supplies.

An agency is desired in Lourenco Marquez, Portuguese East Africa (No. 18,689), for electrical household appliances.

An agency is desired in Munich, Germany (No. 18,704), for electrical household appliances.

An agency is desired in Alicante, Spain (No. 18,670), for gasoline engines or electric motors for water pumping.

An agency is desired in Hamburg, Germany (No. 18,700), for internal-combustion engines and accessories.

LINE MATERIAL FOR WATER-POWER DEPARTMENT IN FINLAND.—Tenders are desired by the Water Power Department of the Government of Finland, Helsingfors (to be mailed before March 1), according to *Commerce Reports*, for suspension insulators, copper cable (or alternatively steel-core aluminum cable with the same conductivity), steel ground wire, splicing sleeves and insulator hardware, for use in connection with the 120,000-volt transmission lines which are to be erected in conjunction with the Imatra hydro-electric project. Copies of the specifications, in English, may be purchased from the Finnish Government Water Power Department, Helsingfors, for 200 Finnish marks ($5.05) each. One copy of the specifications is available for loan by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and may be obtained by referring to No. 193,644.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Boston & Maine Railroad plans to install electric power equipment in connection with a proposed coal-distributing paint at the Mystic Wharf, to cost about $450,000.

WORCESTER, MASS.—The City Council is considering extensions in the street-lighting system. Henry A. Knight is superintendent of street lighting.

Middle Atlantic States

ASHFORD, N. Y.—Authority has been granted the Niagara, Lockport & Ontario Power Company, Buffalo, to extend its system and exercise a franchise to supply electricity in a portion of the town.

EAST HAMPTON, N. Y. — The Public Service Commission has approved the petition of the East Hampton Electric Light Company to extend its transmission lines in the town of East Hampton and exercise a franchise granted by the Town Board, under which the company is given the right to erect overhead wires instead of underground conduits. In order to obtain additional current the company plans to build a 20,000-volt line from near Sag Harbor to East Hampton, at a cost of about $100,000.

FREDONIA, N. Y. — Plans have been completed by the Niagara, Lockport & Ontario Power Company, Buffalo, for an equipment storage, repair and distributing plant, on Water Street, to cost about $40,000.

LIVINGSTON, N. Y. — Permission has been granted the Blue Hill Light & Power Corporation to build an electric distribution system to serve electricity here. The company proposes to erect a transmission line from the Greenport-Livingston town line to the Potts Memorial Tuberculosis Hospital, and from there to Blue Stores, at a cost of about $16,000.

NEW BERLIN, N. Y.—Plans for rebuilding of the mill of the Beardsley & Sisson Company, with a loss of about $50,000, include a power plant.

NEW YORK, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until Jan. 19 for chemical engine, electrical wire and cables for the Navy Yard, New York.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for the construction of a substation, at 22 East Thirty-third Street, to cost $40,000. William Whitehill, 709 Sixth Avenue, is architect.

SYRACUSE, N. Y.—The Syracuse Lighting Company has petitioned the Public Service Commission for permission to exercise franchises granted by the towns of Cazenovia and Fenner.

MAYS LANDING, N. J.—The Atlantic County Electric Company, Egg Harbor, has submitted a proposal to the Township Committee offering to install a new street-lighting system here.

BROWNSVILLE, PA.—Preliminary work has been started by the West Penn Power Company, Pittsburgh, on the installation of an ornamental street lighting system and rearrangement of the distribution system in Brownsville, West Brownsville and South Brownsville. The entire cost of the work is estimated at $60,000.

CANNONSBURG, PA. — Plans for rebuilding the plant of the Standard Chemical Company, recently destroyed by fire, with a loss of about $100,000, include a power plant.

GLAYSVILLE, PA. — The Penn Bridge Company plans to install electric power equipment in connection with the rebuilding its local steel works, recently damaged by fire with loss of about $550,000.

ETNA, PA.—The Wilkinsburg Ice Company, 208 Centre Avenue, Wilkinsburg, plans to install electric power equipment in its proposed local ice-manufacturing plant, to cost about $200,000.

GREENSBURG, PA. — The Chicago Bridge & Iron Works, Old Colony Building, Chicago, Ill., plans to install electric power equipment in the proposed addition to its local plant, to cost $150,000.

MAUCH CHUNK, PA.—The installation of an ornamental lighting system along the entire length of the Mansion Hill Road, to cost about $20,000, is under consideration by the City Council.

PHILADELPHIA, PA. — The John W. Watson Company, Twenty-fourth and Locust Streets, plans to install electric power equipment in its proposed plant at Aramingo Avenue and Tulip Street, to cost about $250,000, on which bids are being asked on general contract until Jan. 19. The Ballinger Company, Twelfth and Chestnut Streets, is architect and engineer.

WEST CHESTER, PA.—Plans for rebuilding the plant of the P. E. Sharples Dairy Company, recently destroyed by fire, causing a loss of about $200,000, include an electric power plant.

BALTIMORE, MD. — Plans have been filed by the Consolidated Gas, Electric Light & Power Company for an addition to its power plant on Gould Street near McComas Street, to cost about $120,000.

HUNTINGTON, W. VA.—The International Nickel Company, 67 Wall Street, New York, plans to install electric power equipment in the proposed additions to its local mills, to cost about $5,000,000.

WASHINGTON, D. C. — Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Jan. 30, for a quantity of electrical equipment, including panel boards, cable, wire, lighting fixtures, switches, etc., (Panama Circular 1717).

WASHINGTON, D. C. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Jan. 19, for a quantity of electric cable and wire, electric cord, etc., for eastern and western yards (Schedule 4859). Also for a quantity of lead-sheathed cambric insulated cable, for eastern and western yards (Schedule 4858).

North Central States

ADA, MICH.—Plans are being considered by the City Council for the installation of a municipal hydro-electric power plant to cost about $200,000.

ESCANABA, MICH. — Plans are under way by the Escanaba Paper Company to install a turbo-generator, condensing equipment, etc. in power plant at its paper mill.

HILLSDALE, MICH. — The Hillsdale County Electric Company has applied for permission to extend its transmission lines in different sections of the county.

ONTONAGON, MICH.—The City Council is considering securing electricity from the power plant of the Ontonagon Fibre Works and has engaged Charles Foster, Sellwood Building, Duluth, Minn., engineer, to prepare plans and estimates of cost.

WATERVLIET, MICH.—The Watervliet Paper Company plans to install electric

power equipment in connection with the proposed plant extensions to cost about $500,000.

CHILLICOTHE, OHIO. — The Mead Paper Company plans to build a power plant at its local mill, to cost about $400,000. H. P. Carruth is general manager.

CHILLICOTHE, OHIO.—The Chillicothe Paper Company plans to install electric power equipment in connection with proposed extensions in its plant, to cost about $200,000.

COLUMBUS, OHIO.—Rights-of-way for a transmission line between Columbus and Lancaster, and Columbus and Chillicothe, have been acquired by the Columbus Railway, Light & Power Company from the Scioto Valley Railway & Power Company.

DOVER, OHIO.—The Ohio Service Company, Coshocton, Ohio, plans to build a substation on West Third Street, to cost about $400,000. The company will build a transmission line from Newcomerstown to Dover.

TOLEDO, OHIO.—Electric power equipment will be installed in the proposed addition to the plant of the De Villbiss Manufacturing Company, Detroit Avenue, to cost about $500,000, for which bids will be asked in February. Mills, Rhines, Bellman & Nordhoff, Ohio Building, are architects.

EVANSVILLE, IND. — Plans are being prepared by the Mead-Johnson Company for the installation of a turbo-generator, condensing apparatus, stokers, coal-handling equipment, etc., to cost about $90,000, in the power plant at its local works, W. E. Briggs, Holston Building, Knoxville, Tenn., is engineer.

RUSHVILLE, IND. — The City Council contemplates the installation of new equipment in the municipal electric power plant, to cost about $30,000. Charles Brossman, Merchants' Bank Building, Indianapolis, is engineer.

AURORA, ILL. — Permission has been granted the Aurora, Elgin & Fox River Electric Company to erect a 2,300-volt distribution system from Elgin to Udina, and to render electric service along the line.

BLOOMINGTON, ILL.—Plans are under consideration by the City Council for extensions and improvements in the municipal electric plant and waterworks. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

CARBONDALE, ILL. — The Central Illinois Public Service Company, Springfield, plans to install electric power equipment in its proposed local ice-manufacturing plant, and also in a similar plant at Paris, at a total cost of about $100,000.

CHICAGO, ILL.—Permission has been granted the Public Service Company of Northern Illinois to erect a 2,300-volt transmission system from Dundee to Gilbert and Pine Grove to Gilbert and to supply electric service along the route of the proposed line.

CHICAGO, ILL. — The Chicago Cold Storage Company, 3026 East Ninety-second Street, recently organized, plans to install electric power equipment at its proposed cold storage and refrigerating plant at 106th Street and the Calumet River, to cost about $600,000. B. K. Gibson, is architect.

CHICAGO, ILL.—The Waterway Paper Products Company, Kedzie Avenue and Thirty-second Street, plans extensions in its power plant, in connection with other plant expansion, to cost about $250,000.

DIXON, ILL. — The Illinois Northern Utilities Company has applied for permission to erect a 132,000-volt transmission line from Belvidere to Dixon, to replace a 33,000-volt line now in use.

ELGIN, ILL.—The Kerber Packing Company plans to install electric power equipment in connection with the rebuilding of its plant, recently damaged by fire with a loss of about $200,000.

ANTIGO, WIS.—Plans are under way by the Wisconsin Valley Electric Company, Wausau, which recently acquired the property of the Antigo Electric Company, to rebuild the local distribution system. The company also plans to erect a high-tension transmission line to connect with the Wausau plant.

STEVENS POINT, WIS.—The Railroad Commission has granted the Wisconsin River Pulp & Paper Company permission to rebuild and enlarge its dam on the Wisconsin River.

MINNEAPOLIS, MINN. — Plans are being considered by the City Council for installing 200 additional street lamps during 1926 in addition to the 500 ornamental lamps to be installed on First Avenue, North Ninth Street and Camden Place.

AUDUBON, IOWA.—The erection of a high-tension transmission line from Audubon through Irwin and Kirkman to Sioux City is under consideration by the Iowa Light, Heat & Power Company, Carroll.

JASPER, MO. — The Ozark Utilities Company, Bolivar, Mo., plans to erect a transmission line from Bower Mills, for local service.

MARIONVILLE, MO. — Plans are being prepared by Heckenlively & Mark, 642 Landers Building, Springfield, for a cold storage and refrigeration plant for the Marionville Cold Storage Company, to cost about $85,000.

MEXICO, MO.—The Missouri Power & Light Company contemplates improvements to its ice plant, to cost about $75,000.

PUXICO, MO.—The local plant of the Missouri Power & Development Company, Willow Springs, was recently destroyed by fire, causing a loss of about $35,000.

SEDALIA, MO. — The Missouri-Pacific Railroad Company, St. Louis, plans to install electric power equipment at its proposed equipment and material reclamation plant, to cost about $150,000. E. A. Hadley is chief engineer.

FINLEY, N. D.—The Otter Tail Power Company, Fergus Falls, Minn., which recently ecquired the property of the Finley Light & Power Company, plans to erect a transmission line to Finley.

WILLISTON, N. D. — The Montana-Dakota Power Company, Fairmont, Mont., contemplates erecting a transmission line from Bainville, Mont., to Stanley through Williston to Columbus, via Powers Lake to White Earth. A new power station will be built in Williston.

MADISON, S. D. — Extensions to the municipal electric light plant are under consideration.

LINCOLN, NEB.—Bids will be received by the State Board of Control, Capitol Building, until Jan. 22, for electrical supplies required during 1926. E. B. Fairfield is secretary.

Southern States

CHARLOTTE, N. C.—Plans for proposed local mill of the Scandinavia Belting Company, 226 High Street, Newark, N. J., to cost about $10,000, include a power house. Lockwood, Greene & Company, Pershing Square, New York, are architects and engineers.

ELIZABETH CITY, N. C.—The Virginia Electric & Power Company, Richmond, Va., has submitted a proposal to the City Council offering to erect a high-tension transmission from Gilmerton, near Portsmouth, Va., to supply electricity here.

HENDERSONVILLE, N. C. — Contract has been awarded by the Laurel Park Estates, Inc., to the Electric Supply & Equipment Company, 220 North First Street, Charlotte, for equipment and apparatus for lighting about 5 miles of highway through Laurel Park Estates to Jump Off Mountain. The Blue Ridge Power Company will install the system.

BELTON, S. C.—Plans are under way for the construction of a hydro-electric plant (initial capacity of 2,500 kw.) for service at the local mills of the Belton Mills, Inc. J. E. Sirrine & Company, Greenville, are engineers.

EAU GALLIE, FLA.—The City Council is considering the installation of an ornamental lighting system in the downtown section.

JACKSONVILLE, FLA. — The Ford Motor Company, Highland Park, Detroit, plans to install electric power equipment in the proposed addition to its local assembling plant on Wambolt Street, to cost about $200,000.

LAKE CITY, FLA.—The Florida Power & Light Company, Miami, which is negotiating for the purchase of the municipal power station, contemplates erecting a transmission line to Lake City.

LAKELAND, FLA.—Plans are under way to extend the ornamental lighting system on Florida Avenue, from North Street to Hancock Street, a distance of 2 miles. The installation of ornamental lamps on the Lake Wire Drive is also under consideration.

ORLANDO, FLA.—The Orlando Potteries, Inc., plans to install electric power equipment at its proposed plant in the Fairvilla district, to cost about $100,000. A power house is said to be under consideration.

SANFORD, FLA.—Plans are under way for the installation of a new fire-alarm system, covering the entire city, to cost about $15,000.

TAMPA, FLA.—Preliminary plans are being prepared by the Tampa Electric Company for installing a 17,000-hp. turbo-generator with four boilers and new smoke stack at the West Jackson Street station, and a 13,800-volt feeder in the Eleventh Avenue substation.

TAMPA, FLA.—Preparations are being made by W. G. Clark, Miami, managing director of Tampa Beach, Inc., for a development of a 4,000-acre subdivision on Hillsborough Bay, involving an ultimate expenditure of $27,000,000. The plans include an extensive electric lighting system. V. A. McCormack, care of Tampa Beach, Inc., is construction engineer.

VERO BEACH, FLA.—Bids will be received by the City Council until Jan. 28, for the installation of an ornamental lighting system in the downtown district, comprising 227 standards, maintained by underground wires, to cost about $45,000. Carter & Demerow, Vero Beach, are engineers.

GAINESBORO, TENN.—Steps have been taken to erect a transmission line from Gibbs Cross Roads to Gainesboro. Electricity is to be supplied from the steam power plant of the Tennessee Electric Power Company at Carthage. Gainesboro has not electric service.

FLORENCE, ALA. — Bids will be received at the office of the United States Engineer, Florence, Ala., until Jan. 29, for furnishing and installing a switchboard in the navigation lock operator's house at the Wilson Dam. For details see Searchlight Section.

HUNTSVILLE, ALA.—A movement has been started to extend the ornamental lighting system into Washington, Meridian, Holmes and Green Streets, covering about twenty blocks.

SUMNER, MISS.—The City Council is planning to rebuild the municipal electric light plant and waterworks, recently damaged by fire, with loss of about $100,000.

THORNTON, ARK.—The South Lumber Company plans to install electric power equipment in connection with the rebuilding of its local saw and lumber mills, recently damaged by fire, with loss of about $300,000.

DE RIDDER, LA.—The Louisiana Public Utilities Company, New Orleans, which recently acquired the property of the De Ridder Light & Power Company, contemplates extensions to its transmission lines in this section.

LAKE CHARLES, LA.—The Louisiana Electric Company, Inc., a subsidiary of the Eastern Texas Electric Company, Beaumont, has authorized Stone & Webster, Inc., Boston, to design and build a step-down substation at Lake Charles and another at Jennings. The latter will be equipped with remote-controlled oil circuit breakers. T. R. Thornberg, superintendent, Beaumont, will have charge of the work.

NEW ORLEANS, LA.—Plans are being prepared by Favrot & Livaudais, Hibernia Building, for an eight- or ten-story office building to be erected on Baronne Street, for the New Orleans Public Service, Inc.

PONCA CITY, OKLA.—The Ponca City Milling Company plans to build a power plant at its proposed local flour and feed mills, to cost about $150,000. Horner & Wyatt, Board of Trade Building, Kansas City, Mo., are engineers.

SAND SPRINGS, OKLA.—Applications have been filed by Charles Page, president of the Sand Springs Light & Power Company, for permission to build three dams in addition to one for which an application has already been made. Two of the dams will be located on the Illinois River in Adair and Cherokee Counties, Okla., and the third in Arkansas on the Illinois River. It is proposed to build hydro-electric power plants on each of the sites, at a total cost of about $3,000,000.

WAURIKA, OKLA.—The Southwestern Light & Power Company, Lawton, contemplates erecting a transmission line (26 miles long) from Waurika to Duncan, via Comanche and Addington, to cost about $35,000.

WAYNOKA, OKLA.—Preliminary plans are being prepared for the Railway Ice Company, 309 South La Salle Street, Chicago, for the erection of an addition to its local plant in the Santa Fe yard, to cost about $75,000.

BURNET, TEX.—The installation of an improved local street-lighting system is under consideration by the Texas Public Utilities Company, Bowie.

ELGIN, TEX.—The Texas Power & Light Company, Dallas, is considering extensions in its transmission lines in this vicinity.

LULING, TEX.—The installation of ornamental lamps on Beverly Glen Boulevard, from Santa Monica Boulevard to Wilshire Boulevard has been authorized by the City Council.

MARSHALL, TEX. — Plans are under way by the East Texas Public Service Company for the construction of an ice plant, to cost about $150,000.

SULPHUR SPRINGS, TEX.—The Texas Public Utilities Company, Bowie, which recently purchased the local electric plant, plans to extend its transmission line to Sulphur Springs.

Pacific and Mountain States

ABERDEEN, WASH.—The City Council is considering calling an election to vote on the proposal to issue $2,000,000 for a municipal hydro-electric plant on the Wynooche River, with transmission system.

SULTAN, WASH.—Four permits have been issued by the State Supervisor of Hydraulics authorizing the Sultan Electric Company to build two hydro-electric plants, taking water from three different streams. The cost of the project is estimated at $505,000.

PORTLAND, ORE.—The Northwestern Electric Company plans to build two substations on East Thirty-second Street, and Weidler Street, respectively, at a cost about $60,000. Sutton & Whitney, Lewis Building, are architects. The company also has plans under way for an equipment, repair, distributing and storage building, at Loring and River Streets, to cost about $150,000. Martin Schact, Yeon Building, is architect.

ALHAMBRA, CAL.—The City Commission is considering the installation of ornamental lamps in Emery Park, using cast iron standards. M. H. Irvine is city manager.

FRESNO, CAL.—Plans are being considered by the Pacific Fruit Express Company, 65 Market Street, San Francisco, to build an ice manufacturing and cold storage plant of 70,000 tons capacity, to cost about $500,000, in the Southern Pacific tract in Fresno.

LONG BEACH, CAL.—The City Council is considering the installation of ornamental lamps on Locust Avenue, between Ocean Boulevard and Tenth Street.

LOS ANGELES, CAL.—The City Council plans to install ornamental lamps on a portion of La Mirada Avenue, and also on Los Robles Avenue between Winthrop Road and the north city limits.

LOS ANGELES, CAL.—The City Council has adopted an ordinance providing for the installation of ornamental lamps on Serrano Avenue, using pressed steel standards. The Council is also considering the installation of ornamental lamps on Temple Street, from Benton Way to Parkview Street.

PINOLE, CAL.—Plans for the proposed local plant, to cost about $175,000, of the California Woolen Mills, Inc., recently organized, to be erected on San Plabo Bay, include a power house.

SAN BERNARDINO, CAL.—The Board of City Trustees is considering the installation of an electric fire-alarm system to cost about $60,000. William Harrison is city electrician.

VALLEJO, CAL.—The Board of City Trustees is considering the installation of ornamental lamps on Sacramento Street, from Georgia to Virginia Streets.

FAIRMONT, MONT. — Extensions and improvements are contemplated by the Montana-Dakota Power Company, including the erection of transmission lines between Glendive and Stanley, Mont., Scobey and Bainville, Mont.; from Bainville, Mont., to Stanley through Williston, N. D., Columbus to White Earth, via Powers Lake, N. D. A new power station will be erected at Williston.

Canada

FORT WILLIAM, ONT.—A bylaw authorizing an appropriation of $250,000 for the construction of a municipal electric power station and extension of the 2,200-volt distribution system will be submitted to the ratepayers.

FORT WILLIAM, ONT. — The Hydro-Electric Power Commission of Ontario contemplates the construction of a building, to cost $288,000, which will include an outdoor substation, steel towers and connecting steel towers from the inter-city boundary. This is in addition to the proposed hydro station and distribution system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 15, 1925)

1,565,562. ELECTRON-DISCHARGE DEVICE; T. R. Griffith, Dover, N. J. App. filed Feb. 21, 1925.

1,565,564. METHOD OF AND MEANS FOR INTRODUCING POTASSIUM OR OTHER VAPORS IN LAMPS; A. M. Hageman, Bloomfield, N. J. App. filed July 23, 1923.

1,565,565. ELECTRIC GAS LAMP; E. L. Harrington, Saskatoon, Saskatchewan, Canada. App. filed Feb. 2, 1922.

1,565,569, 1,565,570. ELECTRIC-DISCHARGE DEVICE; W. G. Houskeeper, New York, N. Y. App. filed July 21, 1922.

1,565,578. TESTING FIXTURE; J. McDonough, Chicago, Ill. App. filed April 10, 1922.

1,565,579. METHOD OF INTRODUCING GETTER MATERIALS INTO INCANDESCENT LAMPS; D. MacRae, East Orange, N. J. App. filed July 28, 1921.

1,565,600. ELECTRON-DISCHARGE DEVICE; E. R. Stoekle, Milwaukee, Wis. App. filed March 20, 1916.

1,565,603. ELECTRON-DISCHARGE DEVICE; R. F. Trimble, Elizabeth, N. J. App. filed Oct. 4, 1918.

1,565,613. ELECTRICAL MEASURING APPARATUS; G. A. Anderegg, Blackheath, England. App. filed Feb. 10, 1923.

1,565,625. SIGNALING SYSTEM; H. P. Clausen, Mamaroneck, N. Y. App. filed Dec. 6, 1923.

1,565,628. TELEPHONE-INTERCOMMUNICATING SYSTEM FOR AEROPLANES; G. D. Edwards, East Orange, N. J., and W. M. Capen, Mountain Lakes, N. J. App. filed Sept. 25, 1920.

1,565,637. TELEPHONE SWITCH; H. W. Goff, New York, N. Y. App. filed Sept. 18, 1923.

1,565,638. INDUCTION-MOTOR STARTING AND OVERLOAD SWITCH; A. R. Goldrick, Cleveland, Ohio. App. filed July 14, 1923.

1,565,644. AUTOMATIC EXCESS-HEAT FUSE FOR ELECTRIC MACHINES AND APPARATUS; W. Hickel, Zurich, Switzerland, and O. Pletscher, Jr., Albisrieden, Switzerland. App. filed Aug. 11, 1923.

1,565,659. HIGH-VACUUM DEVICE FOR INFLUENCING CURRENTS; J. E. Lillienfeld, Kew Gardens, N. Y. App. filed Sept. 3, 1921.

1,565,666. COMMUTATOR BRUSH; H. W. Muhleisen, Los Angeles, Cal. App. filed Jan. 11, 1923.

1,565,683. METHOD AND APPARATUS FOR ELECTROPLATING; J. G. Swain, Akron, Ohio. App. filed Nov. 12, 1923.

1,565,708. THERMIONIC VALVE; W. R. Bullimore, London, England. App. filed Oct. 11, 1922.

1,565,721. APPARATUS FOR DETERMINING DIELECTRIC STRENGTH; A. W. Empson, London, England. App. filed Jan. 17, 1923.

1,565,724. FILAMENT AND METHOD OF MANUFACTURE THEREOF; G. R. Fonda, Schenectady, N. Y. App. filed July 29, 1920.

1,565,727. TELEPHONE SYSTEM; H. M. Friendly, Chicago, Ill. App. filed March 14, 1917. Automatic, semi-automatic and variations of such systems.

1,565,753. FUSE; E. L. Ogle, Chicago, Ill. App. filed Sept. 1, 1921. Renewable; for clearing motor in case of phase failure.

1,565,786. BATTERY TERMINAL; W. A. Burkholder, Junction City, Kan. App. filed March 28, 1924.

1,565,799. INSULATING STRUCTURE FOR HIGH-POTENTIAL CONDENSERS; W. Dubilier, New Rochelle, N. Y. App. filed Feb. 18, 1921.

1,565,831. CABLE SPLICE; C. Vignos, Canton, Ohio. App. filed May 14, 1923.

1,565,847. CIRCUITS FOR THE PRODUCTION OF PURE MODULATED CARRIER WAVES; R. E. Coram, Newark, N. J. App. filed Sept. 18, 1923.

1,565,855. VACUUM TUBE; J. B. Johnson, Elmhurst, N. Y. App. filed Nov. 26, 1920.

1,565,857. VACUUM-TUBE MANUFACTURE; M. J. Kelly, New York, N. Y. App. filed June 30, 1921.

1,565,873. VACUUM TUBE AND METHOD OF OPERATING THE SAME; H. J. Van der Bijl, New York, N. Y. App. filed Aug. 10, 1920.

1,565,895. ELECTROMAGNETIC GUN; A. B. Blaustein, Butte, Mont. App. filed Oct. 22, 1921.

1,565,904. SIGNALING SYSTEM; J. C. Burkholder, Jr., West End, N. C. App. filed April 17, 1922. Telegraph system.

1,565,908. CAR-LIGHTING SYSTEM; W. L. Conwell, Montclair, N. J. App. filed Oct. 8, 1921.

1,565,925. TRANSMISSION REGULATION; C. W. Green, Milburn, N. J. App. filed Jan. 31, 1925. For use in carrier-current signaling systems.

1,565,954. TELEPHONE-EXCHANGE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Sept. 12, 1918.

1,565,963. CURRENT-SUPPLY SYSTEM; H. O. Rugh, Chicago, Ill. App. filed March 22, 1923.

1,565,981. CIGAR AND CIGARETTE LIGHTER; C. Baia, Palisades, N. J., and A. Aderente, Jersey City, N. J. App. filed April 10, 1924.

1,566,012. CARRIER-WAVE SIGNALING SYSTEM; J. W. Horton, East Orange, N. J. App. filed Dec. 23, 1920.

1,566,034. THERMIONIC METER; J. Mills, Wyoming, N. J. App. filed Sept. 8, 1920.

1,566,086. ELECTRIC MOTOR-CONTROL SYSTEM; R. D. Given, Leamington, England, and H. W. Liddiard, Rugby, England. App. filed Sept. 5, 1923. For performing a series of operations in predetermined sequence.

1,566,091. ELECTRICAL APPARATUS; J. D. Hilliard, Schenectady, N. Y. App. filed June 5, 1922. Oil switch.

1,566,122. CIRCUIT-CONTROLLING DEVICE; F. Roberson, Gary, Ind. App. filed May 16, 1925.

1,566,132. INSULATING STUD; L. E. Underwood, Swampscott, Mass. App. filed July 11, 1924. As used to support brush-holders.

1,566,145. LOOM CLAMP; M. Larson, San Francisco, Cal. App. filed March 1, 1924.

1,566,155. MOTOR-STARTING SWITCH; R. K. Mason, Bantam, Conn. App. filed June 23, 1920.

1,566,185. ATTACHMENT FOR THE HEATING COILS OF ELECTRICAL STOVES; W. T. Elmgren, Vancouver, Wash. App. filed Aug. 27, 1925.

1,566,208. ELECTRIC RESISTANCE WELDING; C. A. Hadley, Inverness, Scotland. App. filed July 8, 1924.

1,566,220. SWIVEL-LAMP FIXTURE; G. Lilly, Indianapolis, Ind. App. filed Oct. 30, 1922.

1,566,245. RADIO-TELEPHONE SYSTEM; Q. A. Brackett, Springfield, Mass. App. filed Sept. 2, 1921.

(Issued Dec. 22, 1925)

1,566,292. ELECTRIC SWITCH; D. N. Thompson, Syracuse, N. Y. App. filed May 26, 1922. For mounting on a face plate or other support.

1,566,293. THERMIONIC DEVICE; H. J. Van der Bijl, New York, N. Y. App. filed Sept. 4, 1919.

1,566,295. PRINTING-TELEGRAPH SYSTEM; E. F. Watson, Yonkers, N. Y. App. filed Oct. 17, 1922.

1,566,302. PRESSURE-OPERATED SWITCH; A. S. Bertanzetti and S. de Pranpero, Fredericktown, Pa. App. filed Dec. 4, 1922.

1,566,311. TELEPHONE-REPEATER CIRCUITS; A. B. Clark, Brooklyn, N. Y. App. filed Oct. 3, 1921.

1,566,333. STATIC-PHASE-SHIFTING APPARATUS; S. M. Lucas, Pittsburgh, Pa. App. filed Oct. 26, 1923.

1,566,345. TRUNK CIRCUITS; G. H. Peterson, Brooklyn, N. Y. App. filed Sept. 23, 1924.

1,566,347. TEMPERATURE-INDICATING DEVICE; A. B. Shaw, North Dartmouth, Mass. App. filed Sept. 15, 1923.

1,556,362. ELECTRIC PLUG; R. B. Benjamin, Chicago, Ill. App. filed April 23, 1920. Attachment plug.

1,566,399. ELECTRIC ELEVATOR SYSTEM; G. B. Grosvenor, Chicago, Ill. App. filed March 7, 1922.

1,566,409. IMPREGNATED ELECTRODE FOR FURNACE WORK; H. A. Lavene, Niagara Falls, N. Y. App. filed Feb. 5, 1923.

1,566,449. ELECTRIC COOKING GRILL; M. Tocchio, Hammersmith, London, England. App. filed Sept. 17, 1923.

1,566,459, 1,566,460. CONTROLLING SYSTEM; C. W. Wyman, Claremont, N. H. App. filed May 14, 1923. For electrically operated mining mechanisms.

1,566,469. TWO-WAY COMMUNICATION SYSTEM; J. F. Farrington, New York, N. Y. App. filed Dec. 23, 1920.

1,566,476. TELEGRAPH TRANSMITTER; B. P. Hayes, Kansas City, Mo. App. filed Feb. 26, 1923.

1,566,484. INCANDESCENT LAMP; F. J. Lauterbach, Brooklyn, N. Y. App. filed April 21, 1919.

1,566,507. ELECTRIC HEATER; T. C. Russell, Chicago, Ill. App. filed June 21, 1924. For space heating.

1,566,543. ELECTROLYTIC CELL; A. E. Knowles, Heswall, England. App. filed April 3, 1924.

1,566,549. CIRCUIT-CONTROLLING DEVICE; J. M. McMeen, Westmont, Ill. App. filed June 19, 1924. Flasher.

1,566,561. SWITCH OPERATOR; G. F. Rauch, Pukwana, S. D. App. filed April 22, 1924. Clock mechanism.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Place of the Private Plant

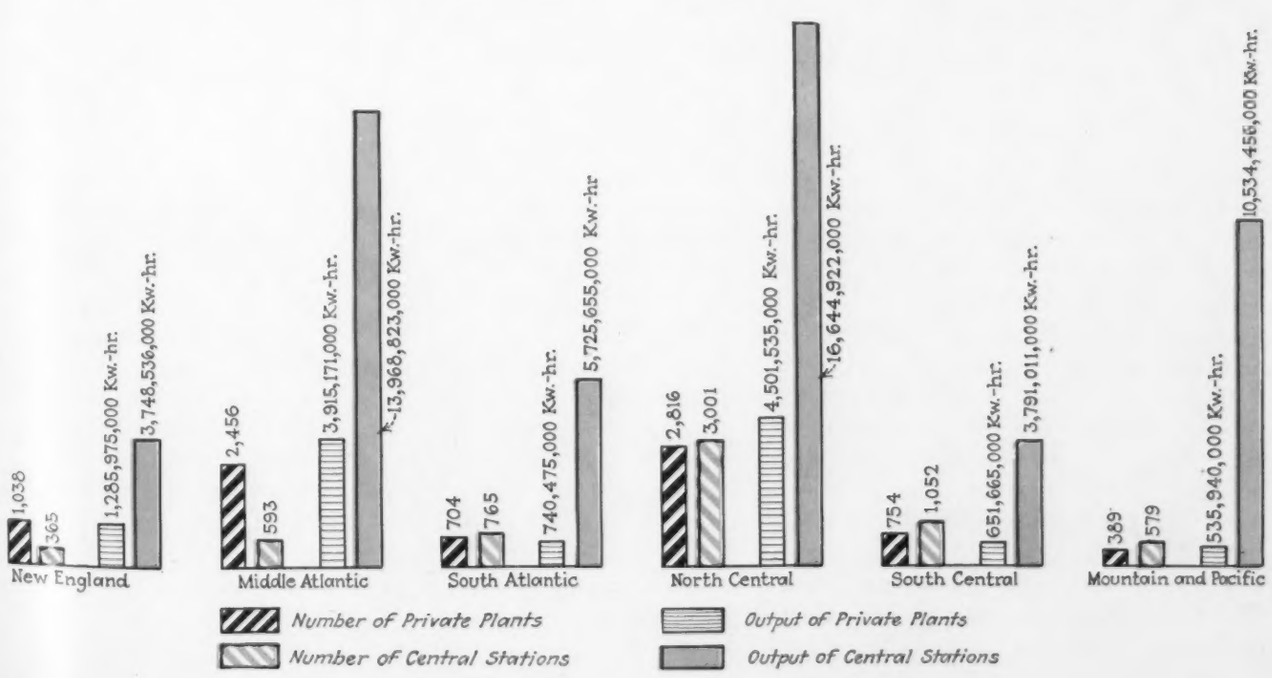
IT MAY truly be said that, throughout its history, despite some stumbling blocks placed in its way by the gas industry, the central station has had only one real rival—the private electric generating plant. The first twenty years of the fight found the private generating plant gaining every year on the central station, until in 1904 approximately 72 per cent of the horsepower of the motors installed in the manufacturing plants of the country were run by energy generated in private plants. But greater efficiency, lower cost and greater dependability finally turned the tide, until at the present time approximately 65 per cent of the horsepower of the motors installed in these plants are run by energy generated in central generating plants. Every industry except the iron and steel now purchases the greater part of its energy from such systems.

There are about eight thousand private industrial electric generating plants in the country today, these plants generating approximately 11,600,000,000 kw.-hr. per annum. So that in some industries and in some sections of the country the generation of energy in private plants still occupies a very conspicuous place in the picture of industrial power. But the presence of the private plant is becoming more and more confined to companies which use large quantities of energy, or to mills and factories which, because of their isolation, do not have access to central-station service.

A study of the growth of private-plant generation in the various sections of the country indicates that New England stands in a class by itself in that since the war the percentage of the total horsepower of motors run by energy generated by private plants has actually increased, while in every other section of the nation the central station has continued to gain on the private plant. On Jan. 1, 1920, the private generating plants were serving 40.9 per cent of the total connected industrial motor load of New England. On Jan. 1, 1924, these plants were serving 41.3 per cent of the total motor load, the rating of motors run by privately generated energy having increased by 306,000 hp. in the four-year period. During the war period the central-station industry in New England made wonderful strides in its connected industrial motor load, far exceeding the proportional growth reported for the country as a whole, and this wonderful growth from 1914 to 1919 intensifies the abrupt swing toward the private plant during the past four years. The rapid growth in New England of industries such as the metals industry which use large amounts of electrical energy in various heating processes provided a fertile field for the growth of the private plant in that section. There is every indication, however, that the central-station companies of New England will have more than regained their former position by the end of the decade.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Number and Output of Private Plants and Central Stations Compared



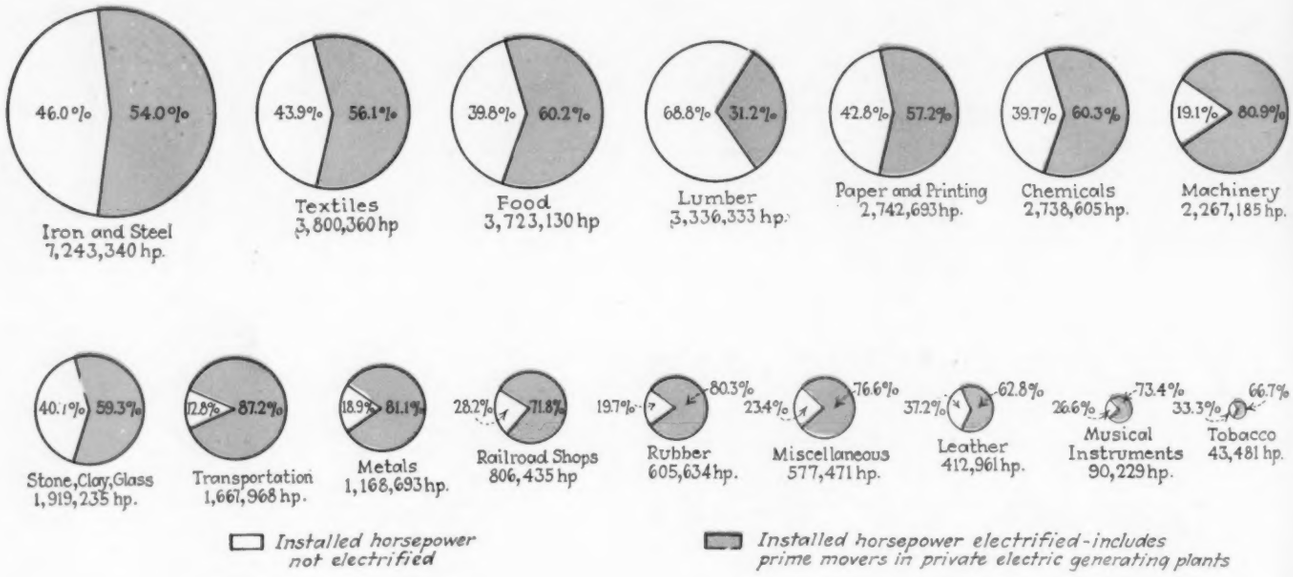
The Industrial Load—Past and Future

WHEN it is remembered that during the year preceding the World War only slightly more than four billion kilowatt-hours of central-station energy was consumed annually for industrial power purposes, and that twelve years later, 1925, almost seven times this amount of energy was consumed by the industries of the country, a vivid picture is gained of the important place which electrical energy has attained in the industrial life of the nation. It really took a world catastrophe to bring home to mankind the advantages of electrical energy as a source of industrial power, but when that idea did take hold, the lighting load and the electric railway load were left a poor second and third respectively. Thus today finds American industry 65 per cent electrified from either private or central generating plants. It was not so very many years ago that a completely electrified industrial plant was a thing worthy of special note, the consummation of extended sales effort on the part of the power engineer. Today a plant run by power other than electric is looked down upon as an "old-timer," a relic of the "good old days" of endless shafts and belts.

So much for the past development and the present status of industrial power. But what of the future? Does the fact that the opening of 1926 finds approximately 65 per cent of industry electrified mean that the remaining 35 per cent represents the future limits of expansion of the central-station industrial load? Such a deduction would be as far from the actual truth as was the deduction of the ancients that because the sky and the seas meet on the horizon therefore the earth must be flat.

The central station has three potential sources from which to draw its future increased industrial power load. The first of these lies in the 35 per cent of the total industrial power which is today not electrified. A portion of this load is not possible or feasible of electrification owing to isolation or to the use of industrial processes in which a type of energy other than electrical is essential, although improved methods will undoubtedly eventually make a large portion of this latter load possible of electrification. The second potential central-station field lies in the taking over of the load now carried by private generating plants. Approximately 32.4 per cent of the industrial electrical load of the country is supplied from private electric generating plants, so it may be stated that the maximum potential industrial load of the central station as it exists today has only been 44 per cent developed.

But the large future of the central-station industrial load lies in the increased use of electrical energy for industrial heating purposes, in electrolytic and electrochemical processes, and in new and unthought-of industrial applications, which will be developed in the years to come. The future industrial load potentialities of the central station are almost beyond comprehension. They make the present development of the industry look like a mere beginning.

The Opening of 1926 Finds American Industry 65 per Cent Electrified

(Data for Industries Are as of Jan. 1, 1924)